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which have been found in the United States, and which are much more numerous than is generally supposed. He showed nearly perfect sculls of four distinct species, belonging to three different genera, and various parts of three more species. Of these seven species, six belong to the family of Zeuglodonts, and one to that of the true Dolphins. They were all found in the lower tertiary deposits of the Southern States. The new types described by Professor Agassiz were discovered by Mr. Holmes of Charleston, South Carolina, and by Mr. Markoe of Washington. It is intended to publish extensive illustrations of all these fossils.

Professor Gray, from the Publishing Committee, announced that a new volume of *Memoirs* was nearly ready for distribution, and proposed that a committee should be appointed to fix some general rules for the disposition of the publications of the Academy. Messrs. Everett, Felton, Gray, Sparks, Agassiz, Walker, and Gould were appointed a committee for this purpose.

Three hundred and eleventh meeting.

November 8, 1848. — Quarterly Meeting.

The President in the chair.

Mr. Everett, from the committee appointed at the last meeting on the discovery of the eighth satellite of Saturn, and on a name suitable to be given to it, read a detailed report, which was referred to the Committee of Publication for the purpose of having it appended to the third volume of Memoirs about to be issued [where it has been printed in full].

Professor Gray presented a Memoir, entitled "Plantæ Fendlerianæ Novi-Mexicanæ: an Account of a Collection of Plants made chiefly in the Vicinity of Santa Fé, New Mexico, by Augustus Fendler; with Descriptions of the New Species, Critical Remarks, and Characters of other undescribed or little known Plants from surrounding Regions"; and made some general observations on the characteristics of the vegetation of New Mexico, now first brought to the notice of botanists.

"Desirous to render the occupation of New Mexico by the United States troops subservient to the advancement of science, and to make known the vegetation of a region which had scarcely been visited by a naturalist, Dr. Engelmann and myself, with the coöperation of one or two friends who patronized the enterprise, induced Mr. Fendler to undertake a botanical exploration of the country around Santa Fé. In execution of this plan, Mr. Fendler left Fort Leavenworth, on the Missouri, on the 10th of August, 1846, with a military train, he having been allowed by the Secretary of War a free transportation for himself, his luggage, and collections.

"Mr. Fendler travelled the well-beaten track of the Santa Fé traders to the Arkansas, and then followed that river up to Bent's Fort, which he reached on the 5th of September. On the 25th of September the Arkansas was crossed, four miles above Bent's Fort, and the westerly course was now changed to a southwestern direction, through an arid and very barren region, where the shrubby *Atriplex* was the most characteristic plant, and furnished almost the only fuel to be obtained. Thus far the country was a comparatively level, or rather rolling, prairie, rising gradually from one thousand to more than four thousand feet above the sea. But on Sept. 27th, the base of the mountain chain was reached, which is an outlier of the Rocky Mountains, and attains in the Raton Mountains the elevation of eight thousand feet. West of these, in dim distance, the still higher Spanish Peaks appear, which have only been visited, very cursorily, by the naturalists of Major Long's expedition in 1820. Scattered Pine-trees are here seen for the first time on the Rio de los Animos (or Purgatory River of the Anglo-Americans), which issues from the Raton Mountains. The party several times crossed large perfectly level tracts, which at this season, at least, showed not a sign of vegetation; in other localities of the same description, nothing but a decumbent species of Opuntia was observed. The sides of the Raton Mountains were studded with the tall *Pinus brachyptera*, Engelm., and the elegant *Pinus concolor*. Descending the mountains, the road led along their southeastern base, across the head-waters of the Canadian.

"On the 11th of October, Mr. Fendler obtained the first view of the valley of Santa Fé, and was disagreeably surprised by the apparent sterility of the region where his researches were to commence in the following season. The mountains rise probably to near nine thousand feet above the sea-level, two thousand feet above the town, but do not

reach the line of perpetual snow, and are destitute, therefore, of strictly alpine plants. Their sides are studded with the two Pines already mentioned, with *Pinus flexilis*, &c.

" The Rio del Norte, twenty-five or thirty miles west from Santa Fé, is probably two thousand feet lower than that town. Its flora is meagre; but some interesting plants were obtained on its sandy banks, or on the black basaltic rocks, which in other places rise directly from its brink. South and southwest of Santa Fé, an almost level and sterile plain extends for fifteen miles, which supports little vegetation, except four or five *Cacteæ*, some Grasses, and here and there a bush of the *Shrub Cedar*. To the west and north there is a range of gravelly hills, thinly covered with *Cedar* and the *Nut Pine*. The valleys between the hills appear to have a fertile soil, but cannot be cultivated for want of irrigation. They furnished some very interesting portions of Mr. Fendler's collection.

" By far the richest and most interesting region about Santa Fé, for the botanist, is the valley of the Rio Chiquito (*little creek*) or Santa Fé Creek. It takes its origin about sixteen or eighteen miles northeast of the town, from a small mountain lake or pond, runs through a narrow, chasm-like valley, which widens about three miles from Santa Fé, and opens into the plain just where the town is built. Below, the stream is almost entirely absorbed by the numerous irrigating ditches, which are most essential for the fertilization of the otherwise sterile fields. Most of the characteristic plants of the upper part of the creek and of the mountain-sides are those of the Rocky Mountains, or of allied forms; some of which, such as *Atragene Ochotensis* or *alpina*, *Draba aurea*, &c., have never before been met with in so low a latitude (under 36°).

" Mr. Fendler made his principal collections from the beginning of April to the beginning of August, 1847, in the region just described. At that time, unforeseen obstacles obliged him to leave the field of his successful researches. He quitted Santa Fé on the 9th of August, followed the usual road to Fort Leavenworth, which separates from the 'Bent's Fort road' at the Mora River, and unites with it again at the 'Crossing of the Arkansas.' The first part of the route from Santa Fé to Vegas leads through a mountainous, wooded country, of much botanical interest, crossing the water-courses of the Pecos, Ojo de Bernal, and Gallinas. From Vegas the road leads northeastwardly through an open prairie country, occasionally varied with higher hills, as far as the Round Mound (6,655 feet high, according to Dr. Wislizenus). The

principal water-courses on this part of the route, all of which furnished different remarkable species, were the Mora, Ocaté, Colorado (the head of the Canadian), and Rock Creek, all of which empty into the Canadian. Rabbit's Ear Creek and McNees Creek (the head-waters of the north fork of the Canadian) are east of the mountains altogether. From thence the Cimarron was reached, where the Cold Spring, Upper, Middle, and Lower Spring, and Sand Creek are interesting localities. On September 4th, Mr. Fendler recrossed the Arkansas, and reached Fort Leavenworth on the 24th of that month.

" The systematic enumeration of the plants collected by Mr. Fendler, at this time presented to the Academy, extends to the close of the Compositæ (Nos. 1 - 462) ; and embraces the following new species, viz. : — *Thalictrum Fendleri. Berberis Fendleri*, a beautiful and very distinct species, allied to B. Canadensis. *Argemone hispida*, — also gathered by Fremont and Wislizenus, — allied to A. grandiflora. *Nasturtium sphærocarpum*, a species with almost exactly globose silicles, as its name indicates. *Streptanthus micranthus*, and *S. linearifolius. Cardamine cordifolia*, a species most resembling C. asarifolia of the Old World. *Sisymbrium incisum*, which has the pods of S. Sophia, but with longer pedicels and much coarser foliage. *Vesicaria Fendleri*, a very distinct species of a genus which appears to have its principal focus in Texas and New Mexico. *Lepidium alyssoides*, which was also found by Fremont. *Drymaria sperguloides*, and *D. tenella*, two remarkable narrow-leaved species. *Arenaria Fendleri*, a grassy-leaved species of a group not before found in the New World. *Sidalcea Neo-Mexicana*, and *S. candida*, belonging to a new genus, of which Sida diploscypha, *Torr. & Gr.*, is the type. *Ceanothus Fendleri. Dalea nana*, Torr. ined., allied to D. aurea. *Astragalus diphysus*, and *A. cyaneus ;* and four new species of *Phaca*, viz. *P. Fendleri, P. gracilenta, P. macrocarpa*, and *P. picta. Calliandra herbacea*, a small, depressed herb. *Mimosa borealis*, a shrub, found north of lat. 37°, also gathered in flower by Mr. Gordon. *Potentilla diffusa*, and *P. crinita. Œnothera (Pachylophis) eximia*, the largest and most striking species of the section, and apparently one of the handsomest of the genus ; and *Œ. (Salpingia) Fendleri*, also a very showy species. The new Cacteæ are *Mammillaria papyracantha, Cereus Fendleri*, and *Opuntia phæacantha*, described by Dr. Engelmann, who has very successfully investigated this family. *Ribes leptanthum. Philadelphus microphyllus*, a charming species. *Archemosa Fendleri. Cy-*

mopterus Fendleri. Thaspium? montanum. Of Loranthaceæ, *Phoradendron juniperinum*, Engelm., with two *Arceuthobia* which Dr. Engelmann considers distinct from the A. oxycedri of the Old World. *Galium Fendleri*, and *G. asperrimum.*

"The following are the new Compositæ of the collection, viz.: — *Clavigera brachyphylla. Brickellia Fendleri. Aster Fendleri. Erigeron canum, E. cinereum*, and *E. flagellare. Townsendia Fendleri* and *T. eximia*, two interesting additions to a genus characteristic of the region (and still another is added from farther south). *Gutierrezia (Hemiachyris) sphærocephala. Franseria tenuifolia*, and *F. tomentosa. Bidens tenuisecta. Sanvitalia Aberti. Heterospermum tagetinum. Lowellia aurea*, a new genus allied to Dysodia. *Schkuhria Neo-Mexicana. Actinella argentea*, the most showy species of the genus. *Amauria? dissecta*, also found by Fremont. *Senecio Fendleri. Cirsium ochrocentrum. Crepis ambigua. Macrorhynchus purpureus.*

"Numerous species and several new genera are characterized in notes to the memoir, of which the greater part are from the North-Mexican collections of Dr. Wislizenus and Dr. Gregg."

Mr. James D. Dana, of New Haven, presented a continuation of his brief synopsis of the characters of the Crustacea obtained during the cruise of the vessels of the United States Exploring Expedition, as follows: —

Conspectus Crustaceorum quæ in Orbis Terrarum circumnavigatione, CAROLO WILKES *e Classe Reipublicæ Fœderatæ Duce, lexit et descripsit* JACOBUS D. DANA. Pars II.*

Familia III. CALANIDÆ.

Oculi simplices; etiam sæpe alii duo inferiores deorsum spectantes. *Pedes mandibulares maxillaresque* articulati et longe setigeri. *Sacculus oviger* unicus. *Antennæ anticæ* elongatæ, non appendiculatæ. *Antennæ posticæ* apice setigeræ.

Genera notis sequentibus distinguenda: † —

* Vide Partem I., Vol. I p. 149.

† Membra pedalia Cyclopaceorum ordine sequentia: —

I. Pedes mandibulares duo (membra cephalothoracis, ad normam, *quarta*, — ct. iv.).

II. Maxillæ duæ (ct. v.).

- Oculis inferioribus nullis.
  - Antennis anticis nec angulo flexis, nec articulatione geniculatis.
    - Pedibus posticis (ct. xii.) non prehensilibus, sæpe obsoletis.
      - Pedibus anticis (ct. vii.) majoribus quam maxillipedes (ct. vi.), lateraliter porrectis, non geniculatis. . . . . . 1. CALANUS.
      - Pedibus anticis minoribus quam maxillipedes. Maxillipedibus sub corpore geniculatis. Abdomine longissimo. 2. SCRIBELLA.
    - Pedibus posticis elongatis, subulatis, uno subprehensili; pedibus anticis duplo geniculatis, sub corpore gestis, apice deflexis. . . . 3. EUCHÆTA.
  - Antennis anticis angulo levissimè flexis, nunquam articulatione geniculatis. Pedibus posticis *maris* prehensilibus. . 4. UNDINA.
  - Antennâ anticâ *maris* dextrâ geniculante.
    - Maxillipedibus duplo geniculatis, inflexis, setis longis, nudis. . . . . 5. CANDACE.
    - Max. rectis, setis longis, setulosis. . . . . 6. CYCLOPSINA.
- Oculis superioribus nullis, inferioribus grandibus. Antennâ anticâ dextrâ *maris* geniculante; aliis *Calano* affinibus. . . . . 7. CATOPIA.
- Oculis inferioribus et superioribus.
  - Antennâ anticâ dextrâ *maris* non geniculante, ambabus flexilibus, setis diffusis. Pedibus posticis parvulis, uniarticulatis. . . . . 8. ACARTIA.
  - Antennâ anticâ dextrâ *maris* geniculante; setis non diffusis. Pede postico dextro crasso, prehensili. . . . 9. PONTELLA.

Genus I. CALANUS. (*Leach.*)

Rostrum furcatum. *Antennæ anticæ* sive leviter curvatæ, sive rectæ, *maris* non geniculantes. *Pedes postici* (ct. xii.) obsolescentes, *maris* non prehensiles. *Pedes antici* (ct. vii.) elongati, latè porrecti, maxillipedibus (ct. vi.) majores, non geniculati. *Oculi inferiores* nulli. Cephalothorax 4 – 5-articulatus. *Rami antennarum posticarum* subæqui, ramo breviore ad apicem 3-setis instructo, in dorso setigero.*

III. Maxillipedes (vel maxillæ) duo (ct. vi.).

IV. Pedes antici (vel maxillipedes) duo (ct. vii.).

V., VI., VII., VIII., et sæpe IX. Pedes biremes octo vel decem (ct. viii., ix., x., xi., xii.).

In ambiguis, etiam numeri (*scil.* ct. iv., ct. v., *etc.*) sæpe subjuncti.

Mandibulum articulus pedis mandibularis primus est, et "palpi" articuli sequentes pedis reliqui sunt.

* Species optime distinguendæ sunt: —

1. Per gestum antennarum anticarum; etiam per setas, præcipuè apicales et subapicales; per longitudinem et numerum articulorum:

2. Per maxillipedes, et pedes anticos:

SYN. — Cyclops, *Müller*. — Calanus, *Leach*. — Cetochilus? *Roussel de Vauzème*.

I. SETÆ ANTENNARUM ANTICARUM APICALES SUBAPICALIBUS LONGIORES.

A. *Styli caudales curti.*

1. CALANUS ROTUNDATUS. — Frons rotundata. Cephalothorax 4-articulatus, crassus, posticè obtusus. Antennæ anticæ corpore vix breviores, 24-articulatæ, duplo curvatæ, apicibus fronte paulo posteriores, articulo ultimo elongato ; setis apicalibus articulum æquantibus, anticis apice remotis, setis subapicalibus minutis. Styli caudales brevissimi ; setis inæquis, secundis abdomine longioribus et apice divaricatis.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat. aust. 32° 24′, long. occ. 166° ; lat. bor. 3°, long. orient. 176° ; lat. bor. 28°, long. orient. 171° 30′. — Lect. die 9 Ap., 1840; die 19 Ap., 1841; et die 17 Maii, 1841.

2. CALANUS COMPTUS. — Frons rotundata. Cephalothorax 4-articulatus, posticè obtusus. Antennæ anticæ tenuissimæ, cephalothorace paulo longiores, fermè 24-articulatæ, duplo curvatæ, apicibus fronte posteriores, articulo ultimo elongato (forsan duplice) ; setis apicalibus articulum fere æquantibus, anticis apice remotis, posticâ penultimâ articuli longitudine, anticâ penultimâ et antepenultimis minutis. Styli caudales breves ; setis strictis, rectis, duobus paulum longioribus.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat. bor. 40°, long. occ. 157° ; lat. bor. 45°, long. occ. 156° ; lat. aust. 21½°, long. occ. 136°. — Lect. diebus 2, 6 Jul., 1841 ; 13 Aug., 1839.

3. CALANUS NUDUS. — Frons rotundata, prominulus. Cephalothorax 4-articulatus, posticè subacutus. Antennæ anticæ cephalothorace vix longiores, fermè 18-articulatæ, articulo ultimo non longiore ; setis totis brevissimis, apicalibus articulo non longioribus, et anticis apice vix remotis, subapicalibus minutis. Styli caudales paulum oblongi, setis rectis, strictis, abdomine non longioribus.

Long. $\frac{1}{20}''$. — *Hab.* in mari Atlantico, lat. bor. 8° - 0°, long. occ. 21° - 18°, et lat. aust. 0° - 6°, long. occ. 18° - 25°. — Lect. diebus 20, 22, 25 Oct., et 1, 3, 5, 8, 12 Nov., 1838.

3. Per pedes posticos thoracicos :

4. Per numerum segmentorum cephalothoracis, et characteres segmentorum antici posticique :

5. Per stylos caudales et eorum setas :

Articulatio cephalothoracis non valet *genera* distinguere. Numerus segmentorum abdominis per ætatem variat, et vix valet *species* distinguere.

4. Calanus Magellanicus. — Frons rotundata. Cephalothorax 4-articulatus, posticè obtusus. Antennæ anticæ corpore breviores, duplo curvatæ, apicibus fronte valde posteriores, articulis quatuor ultimis brevibus, subæquis; setis totis perbrevibus, apicalibus articulo* brevioribus, anticis apice remotis, subapicalibus posticis minutis, anticis obsoletis. Styli caudales perbreves, setis abdominem fere æquantibus.

Long. $\frac{1}{24}''$. — *Hab.* in mari Pacifico, lat. aust. 52°, prope Patagoniam. Lect. die 27 Mar., 1839.

5. Calanus crassus. — Frons rotundata. Cephalothorax crassus, 4-articulatus, posticè vix subacutus. Antennæ anticæ corpore breviores, apicibus fronte valde posteriores, setis brevibus, apicalibus paulo longioribus, subapicalibus minutis, aut obsoletis. Styli caudales perbreves, setis subæquis abdomine paulo brevioribus.

Long. $\frac{1}{16}''$. — *Hab.* in mari Atlantico, lat. aust. 9°, long. occident. 17° 30′. — Lect. die 9 Maii, 1842.

6. Calanus furcicaudus. — Frons triangulata. Cephalothorax 4-articulatus, capite subito angustatus, posticè obtusus. Antennæ anticæ corpore paulo breviores, duplo curvatæ, apicibus fronte posteriores, fermè 24 (26 ?)-articulatæ; articulo ultimo paulo longiore; setis brevibus, prope basin numerosis, apicalibus articulo paulo longioribus et anticis apice parcè remotis, subapicalibus minutis. Styli caudales setæque latè divaricati, setis inæquis, secundis abdomine longioribus.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat. bor. 3°, long. orient. 173°. — Lect. die 28 Ap., 1841.

7. Calanus arcuicornis. — Frons obtusa. Cephalothorax 4-articulatus, capite angustatus, posticè subacutus. Antennæ anticæ cephalothorace vix longiores, leviter arcuatæ, apicibus fronte vix posteriores, articulis 4 ultimis subæquis, setis perbrevibus, apicalibus articulo valde brevioribus, duabus uncinatis, subapicalibus obsoletis, prope basin paucis brevibus uncinatis. Abdomen angustum, lineare. Styli caudales per breves, setis strictis, rectis, abdominis longitudine.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, lat. aust. 32° 24′, long. orient. 178° 15′. — Lect. die 9 Ap., 1840.

B. *Styli caudales valde elongati.*

8. Calanus turbinatus. — Frons obtusa. Cephalothorax anticè crassus, posticè attenuatus (idcirco, segmentum posticum abdomine

* In his, "setæ articulo breviores" et aliis similibus, articulus ille has setas gerens *passim* intelligentus.

parcè latius) obtusiusculus. Antennæ anticæ duplo leviter curvatæ, corpore breviores, tenuissimæ, articulis 5 ultimis subæquis; setis totis perbrevibus, apicalibus subapicalibusque articulo non longioribus. Styli caudales tenues, paralleli, setis dimidio brevioribus.

Long. $\frac{1}{12}''$. — *Hab.* in mari "Sulu." — Lect. die 29 Jan., 1842.

9. CALANUS STYLIFER. — Frons truncata. Cephalothorax curtus, posticè abdomine valde latior et longè acutus, 5-articulatus, segmento ultimo brevissimo. Antennæ anticæ duplo paululum curvatæ, apicibus fronte non posteriores; setis perbrevibus, apicalibus et penultimâ posticâ fere articuli longitudine, penultimâ anticâ et antepenultimis brevissimis. Styli caudales tenues, fere abdominis longitudine, recti, paralleli, setis non longioribus, unâ valde externâ.

Long. $\frac{1}{12}''$. — *Hab.* in mari Atlantico, lat. aust. 23° - 24°, long. occ. 41° - 43°. — Lect. die 19 Nov., 1838, et 9 Jan., 1839.

10. CALANUS CURTUS. — *C. stylifero* similis, sed curtior. Cephalothorax 5-articulatus, segmentis 4 posticis subæquis. Antennæ anticæ corpore paululo longiores,* tenuissimæ, duplo paulum curvatæ, apicibus fronte vix anteriores; setis perbrevibus, apicali anticâ longiore, articulum non superante. Styli caudales tenues, fere abdominis longitudine, vix recti, setis non longioribus, flexuosis, unâ valde externâ.

Long. $\frac{1}{20}''$. — *Hab.* in mari "Sulu"; etiam freto Sundæ. — Lect. die 27 Jan., et die 2 Mar., 1842.

11. CALANUS SCUTELLATUS. — Latè depressus. Cephalothorax 4-articulatus, segmento antico anticè fortè arcuato, posticè latè producto et acuto, segmento postico utrinque longè acuto, et divaricato. Antennæ anticæ corpore paululo longiores, duplo curvatæ, apicibus fronte vix anteriores; setis brevibus, apicali anticâ penultimâque posticâ articuli longitudine, aliis subapicalibus perbrevibus. Styli caudales tenues, fere abdominis longitudine, parcè divaricati.

Long. $\frac{1}{16}''$. — *Hab.* in mari "Sulu." — Lect. die 27 Jan., 1842.

II. SETÆ ANTENNARUM ANTICARUM APICALES SUBAPICALIBUS NON LONGIORES.

A. *Setæ caudales totæ mediocres. Frons obtusa, non elongata.*

a. Cephalothorax 4-articulatus.

12. CALANUS PAVO. — Frons subtriangulata, obtusa. Cephalothorax posticè obtusus. Antennæ anticæ corpore dimidio longiores, duplo

* I. e. stylis exclusis, ut passim.

curvatæ, articulo ultimo longiore, setis longiusculis. Abdomen brevissimum. Styli caudales breves, divaricati, setis fere corporis longitudine, latis, eleganter plumiformibus, flabellatim divaricatis.

Long. $\frac{1}{24}''$. — *Hab.* in mari Atlantico, lat. bor. 12°, long. occ. 24°.— Lect. die 9 Oct., 1838.

13. Calanus levis. — Frons obtusa. Cephalothorax mediocris, posticè subacutus. Antennæ anticæ corpore vix longiores, duplo leviter curvatæ, apicibus fronte non anteriores; setis brevibus, 4–5 remotis longioribus, apicalibus et anticâ penultimâ fere articuli longitudine, posticis penultimâ antepenultimâque paulo longioribus, subæquis, anticâ antepenultimâ obsoletâ. Styli caudales parce oblongi, setis rectis, appressis, abdominis longitudine.

Long. $\frac{1}{20}''$. — *Hab.* in mari Atlantico juxta "Rio de Janeiro." — Lect. die 7 Jan., 1839.

14. Calanus medius. — Frons rotundata. Cephalothorax posticè obtusus. Antennæ anticæ cephalothorace paulo longiores, duplo curvatæ, apicibus fronte posteriores; setis perbrevibus, 4–5 remotis longioribus, posticâ apicali et anticâ penultimâ largè articuli longitudine, posticâ penultimâ paulo breviore, posticâ antepenultimâ duplo longiore. Styli caudales breves, setis appressis, abdomine brevioribus.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, lat. bor. 44°, long. occ. 153°. — Lect. die 6 Jul., 1841.

15. Calanus placidus. — Frons rotundata. Cephalothorax posticè obtusus. Antennæ anticæ corporis longitudine, duplo leviter curvatæ, apicibus fronte paulo posteriores; setis apicalibus brevibus, posticis penultimâ antepenultimâque valde elongatis, anticâ penultimâ dimidio breviore. Styli caudales breves.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, prope insulas "Kingsmill"; etiam lat. bor. 40°, long. occ. 157°. — Lect. die 30 Ap., et 2 Jul., 1841.

16. Calanus recticornis. — Frons obtusa. Cephalothorax posticè rotundatus. Antennæ anticæ corpore longiores, rectissimæ, apicibus fronte non anteriores, articulo primo (2?) crassè oblongo, ultimo paulum demisso; setis brevibus, articuli secundi subelongatâ, articuli antepenultimi posticâ longiore (= 4 artic.), penultimis posticâ et anticâ paulo brevioribus, apicali posticâ minore, articulo longiore, duabus aliis apicalibus brevibus et subuncinatis. Styli caudales breves; setis mediocribus, parcè diffusis.

Long. $\frac{1}{12}''$. — *Hab.* in mari "Sulu." — Lect. die 1 Feb., 1842.

b. Cephalothorax 5 – 6-articulatus.

1. *Cephalothorax posticè obtusus aut breviter subacutus.**

17. Calanus setuligerus. — Frons rotundata. Cephalothorax 5 (6?)-articulatus, posticè obtusus, articulis subæquis. Antennæ anticæ corpore paulo longiores, duplo curvatæ, setis prope basin plerumque duplo longioribus quam articuli et numerosis, setâ articuli sexti (forsan quinti) longiore, setis duabus posticis subapicalibus longis, subæquis, apicalibus brevibus, anticâ penultimâ longiore quam articulus. Styli caudales perbreves; setis mediocribus, parcè diffusis, secundis fere duplo longioribus.

Long. $\frac{1}{16}''$. — *Hab.* in mari Atlantico, lat. bor. 6° – 9°, long. occ. 21° – 24°. — Lect. diebus 13 – 18 Oct., 1838.

18. Calanus pellucidus. — Frons rotundata. Cephalothorax 5-articulatus, posticè obtusus, articulo ultimo brevi. Antennæ anticæ corporis longitudine, setis subapicalibus posticis longiusculis. Styli caudales oblongi.

Long. $\frac{1}{24}''$. — *Hab.* in mari Atlantico, lat. bor. 14½°, long. occ. 21°. — Lect. die 5 Oct., 1838.

19. Calanus affinis. — Frons rotundata. Cephalothorax 5-articulatus, posticè obtusus, articulis posticis subæquis. Antennæ anticæ corporis longitudine, apicibus fronte posteriores; setis brevibus, duabus posticis subapicalibus prælongis, anticâ penultimâ dimidio breviore, apicalibus brevibus. Styli caudales perbreves, setis diffusis, secundis fere duplo longioribus quam primæ.

Long. $\frac{1}{12}''$. — *Hab.* in mari prope insulam "Sumatra." — Lect. die 3 Mar., 1842.

20. Calanus flavipes. — Frons triangulata, vix prominula. Cephalothorax 5-articulatus, posticè attenuatus, obtusus aut subacutus. Antennæ anticæ corpore paulo longiores, duplo leviter curvatæ, apicibus fronte vix posteriores; setas *affini* similes. Styli caudales oblongi, setis mediocribus, non diffusis. Abdomen 2-articulatum; — an adultum?

Long. $\frac{1}{10}''$. — *Hab.* in mari Atlantico, prope "Rio de Janeiro." — Lect. die 7 Jan., 1839.

21. Calanus tenuicornis. — Frons rotundata. Cephalothorax 5-articulatus, posticè obtusus, articulis posticis subæquis. Antennæ anticæ sesqui corporis longitudine, tenuissimæ, duplo levissimè curvatæ,

* Anguli postici cephalothoracis adulti sæpe elongati et subacuti aut acuti.

apicibus fronte vix posteriores, articulis tribus ultimis subæquis; setis brevibus, articuli tertii setâ longiore, setis duabus posticis subapicalibus prælongis, anticâ penultimâ prope dimidio breviore, apicalibus brevibus. Styli caudales oblongi (latitudine duplo longiores).

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat. bor. 40°, long. occ. 157°. — Lect. die 2 Jul., 1841.

22. Calanus sanguineus. — Frons rotundata. Cephalothorax 5-articulatus, posticè obtusus aut subacutus, articulis posticis subæquis. Antennæ anticæ corporis longitudine, fere rectæ, apicibus fronte vix posteriores; setis brevibus, articuli tertii longiore, subapicalibus *tenuicorni* fere similibus. Styli caudales paulum oblongi, setis mediocribus, diffusis, secundis longioribus.

Long. $\frac{1}{10}''$. — *Hab.* in mari Pacifico, lat. bor. 32°, long. occ. 175°; lat. bor. 44°, long. occ. 153°; forsan in mari "Sulu." — Lect. die 28 Maii, et die 6 Jul., 1841, etiam die 28 Jan., 1842. — Var. *perspicax* (oculus transversim reniformis) in mari "Viti," Jul., 1840.

23. Calanus mundus. — Frons rotundata. Cephalothorax posticè obtusus, 5-articulatus, articulis posticis subæquis. Antennæ anticæ corpore parcè longiores, bene rectæ, apicibus fronte non posteriores, articulo primo (2do ?) crassè oblongo et setis inflexis instructo; setis perbrevibus, articuli secundi longiore, apicalibus brevibus, posticâ antepenultimâ longâ, posticâ penultimâ duplo breviore, anticâ penultimâ paulo minore (articulum æquante), anticâ antepenultimâ minutâ. Abdomen 4–5-articulatum. Styli caudales breves, setis appressis, secundis longioribus.

Long. $\frac{1}{10}''$. — *Hab.* in mari Pacifico, lat. bor. 44°, long. occ. 154°.

C. recticorni affinis; sed cephalothorax 5-articulatus.

24. Calanus inauritus. — Frons rotundata. Cephalothorax posticè obtusus, 5-articulatus, articulo ultimo brevissimo. Antennæ anticæ fere rectæ, corpore paulo breviores, articulo primo valde elongato (an duplice ?) tribus setis pendulis subclavatis et aliis setis brevibus uncinatis instructo, setis apicalibus et anticis subapicalibus perbrevibus, subapicalibus posticis articulo vix longioribus, inæquis. Styli caudales breves, setis parcè diffusis aut appressis.

Hab. in mari Atlantico, lat. bor. 6°, long. occ. 21°. — Lect. die 22 Oct., 1838.

2. *Cephalothorax posticè acutus, angulis posticis abdomini appressis.*

25. Calanus simplicicaudus. — Frons obtusa. Cephalothorax 5-

articulatus, segmento postico angusto et posticè brevissimè acuto. Antennæ anticæ corpore paulo longiores, basi arcuatæ, alioque fere rectæ, apicibus fronte parcè posteriores ; setis brevibus, duabus subapicalibus posticis longis, inæquis, anticâ penultimâ duplo breviore, apicalibus brevibus. Abdomen 2-articulatum : (an adultum ?). Styli caudales paulum oblongi.

Hab. in mari Pacifico, lat. bor. 45°, long. occ. 153°.

C. flavipedi abdominem et angustum articulum cephalothoracis posticum affinis ; antennarum anticarum setas apicales subapicalesque *C. sanguineo* similis.

26. Calanus appressus. — Frons obtusa. Cephalothorax posticè attenuatus, angulis posticis elongatè acutis abdominem appressis, 5-articulatus, articulis posticis longitudine subæquis. Antennæ anticæ corpore paulo longiores, duplo leviter curvatæ, articulo ultimo valde graciliore quam penultimus ; setis brevibus, duabus posticis subapicalibus prælongis, subæquis, strenuis, anticâ penultimâ duplo breviore, apicalibus articulo non longioribus. Styli caudales breves ; setis secundis longioribus.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat. bor. 25°, long. orient. 167° ; in mari juxta "Sumatra" ; etiam lat. aust. 30°, long. orient. 13°. — Lect. die 14 Maii, 1841, et die 4 Mar., et 21 Apr., 1842.

3. *Cephalothorax posticè longè acutus, angulis posticis remotis.*

27. Calanus communis. — Frons rotundata. Cephalothorax posticè longè acutus, 5-articulatus, articulis posticis subæquis. Antennæ anticæ corpore paulo longiores, duplo leviter curvatæ, apicibus fronte non anteriores, setis apicalibus brevibus, duabus posticis subapicalibus longis, subæquis, anticâ penultimâ quadruplo breviore, setis totis aliis brevibus. Styli caudales perbreves, setis secundis duplo longioribus.

Long. $\frac{1}{10}''$. — *Hab.* in mari Atlantico, inter lat. bor. 8° et lat. aust. 5°, long. occ. 23° – 15° ; etiam, lat. aust. $4\frac{1}{2}$° – 1°, long. occ. 25° – $30\frac{1}{2}$°. — Lect. diebus 18, 20, 27, 31 Oct., 2, 3, 8, 12 Nov., 1838 ; 13, 16 Maii, 1842.

C. affini similis ; sed anguli postici cephalothoracis longè acuti. An distinctio vera ?

28. Calanus amœnus. — *C. communi* antennas anticas setasque caudales affinis. Cephalothorax 5-articulatus, sed articulo ultimo brevissimo ; angulis posticis longè acutis.

Long. $\frac{1}{10}''$. — *Hab.* in mari Pacifico prope insulas "Samoa," et in mari "Sulu." — Lect. die 26 Feb., 1841, et die 1 Feb., 1842.

29. CALANUS BELLUS. — Frons rotundata. Cephalothorax posticè longè acutus, 5-articulatus, articulis posticis subæquis. Antennæ anticæ corpore paululo longiores, vix duplo curvatæ, apicibus fronte non anteriores; setis brevibus, tertii articuli longâ, duabus posticis subapicalibus longis, subæquis, apicalibus brevibus, anticâ penultimâ paulo longiore. Styli caudales breves, setis diffusis, secundis fere duplo longioribus.

Long. $\frac{1}{8}''$. — *Hab.* in mari "Sulu," et freto "Banca." — Lect. die 2 Feb., et die 2 Mar., 1842.

C. setuligero affinis; sed anguli postici cephalothoracis non obtusi, et setæ caudales valde diffusiores. *C. communi* similis; sed seta tertii articuli antennarum anticarum longa est.

B. *Setæ caudales secundæ longissimæ. Frons sive obtusa, sive triangulato-acuta; rostro longè furcato, brachiis setiformibus.*

30. CALANUS GRACILIS. — Gracilis. Frons rotundata. Cephalothorax elongatus, 5-articulatus, posticè obtusus, articulis posticis subæquis. Antennæ anticæ sesqui corpore longiores, rectæ, 160° inter sese divaricatæ; setis brevibus, duabus posticis subapicalibus longis, apicalibus et anticis subapicalibus brevibus. Abdomen curtum, 4-articulatum. Styli caudales breves, setis secundis dimidio corporis longioribus.

Long. $\frac{1}{8}''$. — *Hab.* in mari Atlantico, lat. aust. $4\frac{1}{2}$°, long. occ. 25°. — Lect. die 13 Maii, 1842.

31. CALANUS ELONGATUS. — Elongatus. Frons breviter triangulata subacuta, rostro longè et tenuiter furcato. Cephalothorax 4-articulatus, anticè angustatus, posticè obtusus. Antennæ anticæ sesqui corporis longitudine, rectæ, et latissimè divaricatæ, apicibus fronte vix anteriores, articulo penultimo abbreviato; setis plerumque brevibus, paucis remotis longiusculis, apicalibus diffusis articulo longioribus, subapicalibus posticis longis, inæquis, anticâ penultimâ minus dimidio breviore, anticâ antepenultimâ obsoletâ. Antennæ posticæ ramo curto 2-articulatæ. Abdomen curtissimum. Styli caudales brevissimi.

Long. $\frac{1}{5}''$. — *Hab.* in mari "Sulu." — Lect. die 1 Feb., 1842.

32. CALANUS ATTENUATUS. — Elongatus. Frons triangulata, acuta, rostro longè et tenuiter furcato. Cephalothorax anticè valde angustatus, posticè obtusus, 5-articulatus, articulo ultimo brevi. Antennæ anticæ corpore valde longiores, prope basin arcuatæ, alioque rectæ et

latissimè divaricatæ, apicibus fronte paulo anteriores, articulo penultimo abbreviato; setis vix brevibus, plerumque fractis, fere æquis, apicalibus et subapicalibus inæquis longiusculis, anticâ antepenultimâ obsoletâ. Antennæ posticæ ramo curto multiarticulato. Abdomen curtissimum. Styli caudales perbreves, setis secundis dimidio corporis longioribus.

Long. $\frac{1}{8}''$. — *Hab.* in mari Pacifico, prope insulas "Kingsmill"; etiam in mari Sinensis. — Lect. die 13 Ap., 1841, et die 15 Feb., 1842.

C. *Frons valde elongata; rostro breviter valdeque furcato. Setæ caudales secundæ longissimæ* (?).

33. CALANUS ROSTRIFRONS. — Gracillimus. Frons valde elongata, subacuta. Cephalothorax anticè paulo angustior, posticè rotundatus, 5-articulatus, articulo postico brevi, articulis penultimo antepenultimoque posticè acutis. Antennæ anticæ corpore valde longiores, leviter arcuatæ, latè divaricatæ, apicibus fronte anteriores, setâ articuli secundi longiusculâ, setis apicalibus articulo vix longioribus, duabus subapicalibus posticis longis. Abdomen curtum. Styli caudales latitudine fere duplo longiores; setis latissimè diffusis.

Long. $\frac{1}{8}''$. — *Hab.* in mari "Sulu." — Lect. die 2 Feb., 1842.

34. CALANUS CORNUTUS. — Gracillimus. Frons valde elongata, subacuta. Cephalothorax posticè rotundatus, 5-articulatus, articulo postico fere obsoleto, articulis tribus precedentibus posticè acutis. Antennæ anticæ sesqui corporis longitudine, fere rectæ, vix arcuatæ, apicibus fronte paululo anterioribus; setâ articuli tertii longiusculâ, setis apicalibus et penultimis brevibus, posticâ antepenultimâ longiore. Abdomen curtum. Styli caudales elongati; setis valde diffusis.

Long. $\frac{1}{8}''$. — *Hab.* in mari Atlantico, lat. bor. 1°, long. occ. 18°. — Lect. die 3 Nov., 1838.

Genus II. SCRIBELLA. (*Dana.*)

Antennæ anticæ elongatæ, pauci-articulatæ, longè setigeræ, setis diffusis, *maris* non geniculantes. *Antennæ posticæ* simplices (?). *Maxillipedes* (ct. vi.) maximi, pedibus proximis majores, 4-articulati, geniculati et prorsum flexi. *Oculi inferiores* nulli. *Cephalothorax* 4–5-articulatus, capite non discreto. *Abdomen* valde elongatum, cephalothorace non brevius. *Styli caudales* oblongi, divaricati. [Sæpius, e basi pedis biremis, seta grandis lateraliter porrecta.]

SYN. — Scribella, *D.*, Amer. Jour. Sci., Ser. 2da, I. 227.

1. Scribella scriba. — Antennæ anticæ latè (130°) divaricatæ, fere corporis longitudine, 7-articulatæ, articulis secundo, quarto et duabus ultimis brevioribus, setis longissimis. Seta pedium biremium externa grandis, eleganter plumiformis. Abdomen 5-articulatum, cephalothorace longius, setis basalibus duabus longiusculis rectis. Styli caudales tenues, setâ externâ fere styli longitudine.

Long. $\frac{1}{20}''$. — *Hab.* in mari Atlantico, lat. bor. $4\frac{1}{2}°-7°$, long. occ. $20°-22°$; et lat. aust. 1°, long. occ. 30° 30′. — Lect. diebus 22, 23, 24, 26 Oct., 1838, 16 Maii, 1842. Forsan in mari Pacifico, prope insulas "Kingsmill"; an eadem species? — Lect. Ap., 1841.

2. Scribella setiger. — Antennæ anticæ fere corporis longitudine, latè divaricatæ, 7-articulatæ, articulis 3 ultimis brevissimis, tertio quartoque prælongis, setis longissimis. Seta pedium biremium externa longa, nuda, tenuissimè subclavata. Abdomen 5-articulatum, segmentis subæquis, setis basalibus duabus, unâ prælongâ, alterâ brevi. Styli caudales tenues, setâ externâ valde longiore quam stylus et prope basin styli insitâ.

Long. $\frac{1}{20}''$. — *Hab.* in mari Pacifico, prope insulas "Kingsmill." — Lect. die 18 Ap., 1841.

3. Scribella abbreviata. — Antennæ anticæ latè divaricatæ, 7-articulatæ, articulis duabus ultimis brevibus, tertio, quarto, quintoque subæquis. Setæ externæ pedium biremium obsoletæ (an distinctio sexualis?). Abdomen 4-articulatum setis basalibus dimidio abdominis valde brevioribus, subæquis, curvatis. Styli caudales paulum divaricati; setâ externâ perbrevi. — An S. *setigeræ* femina? Vix credo.

Long. $\frac{1}{24}''$. — *Hab.* in mari Pacifico, prope "Tierra del Fuego"; etiam lat. aust. 24°, long. occ. 175°; lat. bor. $44\frac{1}{2}°$, long. occ. 153°. — Lect. die 21 Jan., 1839; die 21 Ap., 1840; die 7 Jul., 1841.

Genus III. EUCHÆTA. (*Philippi.*)

Frons acuta. *Rostrum* transversim emarginatum. *Antennæ anticæ* duplo leviter curvatæ, nunquam minimè angulo flexæ, *maris* non geniculantes. *Pedes postici* (ct. xii.) ambo maris valde elongati, subulati. *Pedes antici* (ct. vii.) maxillipedibus (ct. vi.) majores, duplo geniculati et sub corpore gesti, penecillum setarum nudarum reflexum ferentes. *Oculi inferiores* nulli. *Cephalothorax* 4–5-articulatus, capite non discreto.

Syn. — Euchæta, *Philippi*, Archiv für Naturgeschichte, Vol. IX. p. 55.

1. Euchæta communis. — Cephalothorax nudus, 4-articulatus, posticè obtusus. *Feminæ:* antennæ anticæ corpore vix breviores, setis paucis remotis prælongis, rectis, et aliis duabus flexis longissimis, apicalibus prælongis, posticâ antepenultimâ fere articuli longitudine. Setæ caudales rectæ, secundâ sæpius corporis longitudine. Ova cærulea. *Maris:* antennæ anticæ corpore paulo breviores, angulo levissimè flexæ, setis brevibus, paucis articulum apicalem vix superantibus. Pedes postici longissimi, longè subulati. Setæ caudales abdominis longitudine.

Long. $\frac{1}{8}''$. — *Hab.* in mari Atlantico, lat. bor. 9° – 0°, long. occ. 17° – 23°, et lat. aust. 0° – 13°, long. occ. 17° – 32°. — Lect. diebus 15, 18, 20, 24, 26, 27, 29, 30, 31 Oct., et 1, 3, 5, 9, 12 Nov., 1838; etiam die 11 Maii, 1842.

2. Euchæta concinna. — Cephalothorax nudus, ellipticus, capite lateraliter arcuatus, angulis posticis paulum productus et obtusus; *feminæ* 4-articulatus, *maris* 5-articulatus articulo postico perbrevi. Antennæ anticæ corpore paulo breviores, *feminæ*, *marisque* iis *E. communis* fere similes, setâ antepenultimâ posticâ brevissimâ. Setæ caudales abdomine breviores, secundâ *feminæ* fere corporis longitudine, *maris* abdominem paulo superantibus.

Long. $\frac{1}{10}''$. — *Hab.* in freto "Banca." — Lect. die 1 Mar., 1842.

3. Euchæta pubescens. — *Feminæ:* Cephalothorax pubescens, capite lateraliter angulatus, 5-articulatus, articulo postico perbrevi, subacuto. Antennæ anticæ corpore paulo breviores, setas *E. communi* fere similes, setis antepenultimis brevissimis. Pedes antici apice 5-articulati et subelongati. Abdomen 4-articulatum, articulo primo secundum longitudine duplo superante. Seta caudalis secunda fermè corporis longitudine.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, in Archipel. "Paumotu." — Lect. die 29 Aug., 1839.

4. Euchæta diadema. — *Feminæ:* Cephalothorax pubescens, capite lateraliter angulatus, 4-articulatus, posticè obtusus. Antennæ anticæ fere corporis longitudine, setas *E. communi* fere similes, setâ posticâ penultimâ dimidium posticæ apicalis superante, setis antepenultimis brevissimis. Pedes antici apice 5 – 7 articulati, perbreves. Abdomen elongatum, articulo primo secundum longitudine paulo superante. Seta caudalis secunda corpore longior, nuda.

Long. $\frac{1}{7}''$. — *Hab.* in mari Pacifico, prope insulas "Kingsmill." — Lect. diebus 23, 24, 25 Mar., 1841.

Genus IV. UNDINA. (*Dana.*)

Antennæ anticæ ante medium angulo leviter flexæ, apicibus fronte posteriores, *maris* non geniculantes. *Pedes postici* (ct. xii.) *maris* grandes, dextro subcheliformi. *Pedes antici* (ct. vii.) elongati, maxillipedibus sæpe majores et valde porrecti, non geniculati. *Oculi inferiores* nulli. *Cephalothorax* 4 – 5-articulatus, capite non discreto.

1. UNDINA VULGARIS. — Frons obtusa. Cephalothorax 4-articulatus, posticè rotundatus. Antennæ anticæ corporis longitudine, ad articulum octavum leviter reflexæ; setis brevibus, setâ articuli tertii longâ, flexâ, setis apicalibus perbrevibus, unâ uncinatâ, posticâ antepenultimâ longiusculâ, penultimis anticâ posticâque paulo brevioribus, hâc ad extremitatem uncinulatâ. Abdomen 5-articulatum. Styli caudales breves, setâ secundâ duplo longiore.

Long. $\frac{1}{12}''$. — *Hab.* in freto "Banca," juxta insulam "Sumatra"; etiam in mari Atlantico, lat. aust. 4° – 9°, long. occ. 17½° – 25°. — Lect. die 1 Mar., et diebus 9, 13 Maii, 1842.

2. UNDINA SIMPLEX. — Frons obtusa. Cephalothorax posticè rotundatus, 5-articulatus, articulo ultimo breviore. Antennæ anticæ corporis longitudine, articulo primo elongato; setis perbrevibus, setâ articuli secundi longiusculâ, flexâ, setis penultimis articuli longitudine et rectis, posticâ antepenultimâ dimidio longiore, apicalibus minutis, unâ uncinatâ.

Long. $\frac{1}{20}''$. — *Hab.* in mari Pacifico, prope insulas "Kingsmill," et lat. bor. 25°, long. orient. 167°. — Lect. die 25 Mar., et die 14 Maii, 1841.

3. UNDINA INORNATA. — Frons rotundata. Cephalothorax posticè vix acutus, 5-articulatus, articulo postico brevi. Antennæ anticæ corporis longitudine, setis perbrevibus, setâ articuli secundi (tertii ?) longiusculâ, rectâ, setâ apicali posticâ articuli longitudine, anticâ penultimâ sublongâ, posticâ brevi, posticâ antepenultimâ articulum vix superante. Styli caudales parcè oblongi.

Long. $\frac{1}{12}''$. — *Hab.* in mari Atlantico, lat. bor. 4°, long. occ. 19°. — Lect die 27 Oct., 1838.

Genus V. CANDACE. (*Dana.*)

Frons quadrata. *Oculi inferiores* obsoleti. *Antennæ anticæ* regulariter et breviter setigeræ, transversæ; dextrâ *maris* articulatione geniculante. *Maxillipedes* (ct. vi.) pedibus proximis majores, duplo

geniculantes et inflexi, 4 articulati, setis nudis, longis. *Pedes postici maris* dispares, dextro prehensili. *Abdomen* mediocre. *Styli caudales* breves, setis strictè appressis. [Animal sæpius partim nigrescens.]

SYN. — Candace, *D.*, Amer. Jour. Sci., Ser. 2da, I. 228. 1846.

1. CANDACE ORNATA. — *Maris :* Cephalothorax 5-articulatus, articulis posticis quatuor, angulis posticis longè acutis, dextro longiore. Antennæ e basi arcuatæ, alioque rectè transversæ, corpore parcè breviores, articulo secundo paulum oblongo ; setis brevibus, quorum paucis secundo articulo parcè longioribus, apicali posticâ articuli longitudine, posticâ penultimâ paulo longiore, anticâ penultimâ breviore. Antennarum posticarum ramus brevis tenuis, valde brevior. Pes posticus dexter mediocris, articulo ultimo subuncinato, appendice laterali subcorneâ, articulum uncinatum longitudine superante.

Long. $\frac{1}{8}''$. — *Hab.* in mari Atlantico, lat. bor. 9° – 7°, long. occ. 19° – 21° ; etiam lat. aust. 6°, long. occ. 24°. — Lect. diebus 13, 18 Oct., 8 Nov., 1838.

2. CANDACE PACHYDACTYLA. — *Maris :* Cephalothorax 4-articulatus, angulis posticis longè acutis et setâ minutâ extus instructis. Antennæ anticæ fermè corporis longitudine, 23-articulatæ, e basi arcuatæ, deinde rectè transversæ ; dextrâ 21-articulatâ, medio incrassulatâ, articulo geniculationem præcedente valde elongato, et versus apicem subtilissimè pectinato, sequente non breviore. Antennarum posticarum rami longitudine subæqui. Pes posticus dexter crassus, apice rotundatus, appendice laterali crassè falcatâ, obtusâ.

Long. $\frac{1}{12}''$. — *Hab.* in mari Atlantico, lat. aust. 1° – 11°, long. occ. 14° – 30°. — Lect. diebus 7, 9, 13, 16 Maii, 1842.

3. CANDACE ETHIOPICA. — *Maris :* *C. ornatæ* antennas anticas et cephalothoracem affinis. Cephalothorax 4-articulatus. Antennæ anticæ e basi arcuatæ ; articulo antennæ dextræ articulationem geniculantem precedente omnino subtilissimè pectinato. Pes posticus dexter subclavatus, obtusus, setâ elongatâ, appendice laterali setaceâ, longâ, corneâ, flexâ. Antennarum posticarum ramus brevis parvus.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat. aust. 18°, long. occ. 124° ; lect. die 8 Aug., 1839 : lat. bor. 15°, long. 180° ; lect. Dec., 1841.

4. CANDACE CURTA. — *Maris :* *C. ornatæ* similis. Cephalothorax 5-articulatus, posticè acutus. Pes posticus dexter apice subulatus, appendice laterali curtâ, spiniformi. Antennæ anticæ corpore parcè lon-

giores, a basi arcuatæ; articulis **13, 14, 15, 16, 17** antennæ dextræ incrassulatis, articulo **17** elongato apice prominulo, partim subtilissimè pectinato, sequentibus sex brevibus, et tenuissimis.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico prope "Valparaiso." — Lect. die 10 Ap., 1839.

5. Candace aucta. — *Feminæ:* Cephalothorax 5 – 6-articulatus, posticè subacutus aut obtusus. Antennæ anticæ fere corporis longitudine, e basi arcuatæ, apice prorsum parcè flexæ, articulo secundo longo et crasso. Abdomen 2 – 3-articulatum.

Long. $\frac{1}{24}''$. — *Hab.* in mari Pacifico, lat. aust. 9°, long. occ. 174°; etiam prope insulas "Kingsmill"; quoque in mari "Sulu." — Lect. die 26 Jan., 1841; die 14 Ap., 1841; Dec., 1841; die 28 Jan., 1842.

6. Candace truncata. — *Feminæ:* Cephalothorax posticè truncatus. Antennæ anticæ corporis longitudine, prope articulum sextum flexæ, deinde rectè transversæ et tenuissimæ; articulo secundo crasso, non longiore quam articulus tertius quartusve.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, prope insulas "Samoa" et "Kingsmill," et in mari "Sulu." — Lect. die 25 Mar., et die 1 Ap., 1841; die 2 Feb., 1842.

Genus VI. CYCLOPSINA. (*Milne Edwards.*)

Rostrum furcatum. ***Antennæ anticæ*** sive rectæ, sive leviter curvatæ, ***maris*** dextrâ articulatione geniculante. ***Maxillipedes*** (ct. vi.) pedibus proximis majores, non geniculati, setis longis spinulosis instructi. ***Oculi inferiores*** nulli. ***Cephalothorax*** 4 – 7 articulatus, capite sæpe discreto. ***Antennæ posticæ*** iisdem ***Calani*** similes. ***Pes posticus dexter maris*** grandis et prehensilis. [Maxillipedes, et *maris* antennam anticam dextram pedemque posticum dextrum, *Pontellæ* affinis; antennam posticam, oculos, et habitum, *Calano* similis. *Si oculi inferiores* adsunt, species *Pontellæ pertinent.*]

Syn. — Cyclopsina (C. castor), *Milne Edwards.* — Cetochilus? *Roussel de Vauzème.* — Monoculus (M. Castor), *Jurine.* — Cyclops (C. castor), *Desmarest.* — Dioptomus (D. castor), *Westwood.* — Non Cyclopsina *Bairdii.*

1. Cyclopsina longicornis. — Frons rotundata. Cephalothorax posticè obtusus, 5-articulatus, articulis posticis æquis. Antennæ anticæ sesqui corporis longitudine, rectiusculæ, setis brevibus, duabus subapicalibus posticis prælongis, subæquis, apicalibus perbrevibus, anticâ penultimâ articuli longitudine. Styli caudales breves.

Long. $\frac{1}{8}''$. — *Hab.* in mari Atlantico, lat. aust. 4°, long. occ. 21°. — Lect. die 7 Nov., 1838. — An *Cetochilo septentrionali* (Goodsir) affinis?

2. Cyclopsina calanina. — Gracilis. Frons triangulata. Cephalothorax posticè obtusus, 6-articulatus, capite vix discreto, articulis posticis æquis. Antennæ anticæ corpore longiores, tenuissimæ, rectiusculæ, apicibus fronte non posteriores; setis brevibus, apicalibus anticis articuli longitudine, subapicalibus totis valde brevioribus; antenna *maris* dextra medio leviter incrassata. Styli caudales elongati, divaricati.

Long. $\frac{1}{10}''$. — *Hab.* in mari Pacifico, prope insulam "El Gran Cocal." — Lect. die 25 Mar., 1841.

3. Cyclopsina tenuicornis. — *Maris:* Frons triangulata. Cephalothorax posticè fere obtusus, 7-articulatus, capite discreto, articulis posticis æquis. Antennæ anticæ corpore longiores, apicibus fronte vix anteriores, tenuissimæ, rectiusculæ, setis brevibus, anticis apicalibus fere articuli longitudine, posticâ penultimâ paulo longiore. Abdomen 3-articulatum. Styli caudales elongati divaricati.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, prope insulam "Depeyster"; lect. die 22 Mar., 1841. Etiam (?) in Archip. "Paumotu"; lect. Aug. 13, 1839.

4. Cyclopsina gracilis. — *Maris:* Antennæ anticæ corpore valde longiores; abdomen 4-articulatum; aliis *C. tenuicorni* similis.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, lat. bor. 25°, long. orient. 167°. — Lect. die 14 Maii, 1841. — An var. *C. tenuicornis.*

Genus VII. CATOPIA.

Antennas posticas et antennarum habitum anticarum *Calano* affinis. Antennam anticam *maris* dextram *Pontellæ* affinis. *Oculi* superiores nulli; oculus inferior unicus (?).

Catopia furcata. — Gracilis. Caput quadratum, non discretum. Cephalothorax 4-articulatus, posticè 4-dentatus, dentibus acutis, externis longioribus. Styli caudales oblongi, divaricati. Antennæ anticæ corpore longiores, duplo curvatæ, apicibus fronte non anteriores; setis totis brevibus.

Long. $\frac{1}{16}''$. — *Hab.* in freto "Banka." — Lect. die 2 Mar., 1842.

Genus VIII. ACARTIA. (*Dana.*)

Antennæ anticæ rectiusculæ, flexiles, setis irregulariter diffusis, dextrâ *maris* non geniculante. *Maxillipedes* (ct. vi.) pedibus proximis majores, recti, setis setulosis longis instructi. *Pedes postici* (ct. xii.)

parvuli, uni-articulati, 2 setas divaricatas gerentes. *Oculi* duo inferiores et duo superiores. *Setæ caudales* mediocres.

1. ACARTIA LIMPIDA. — Gracilis. Frons triangulata. Cephalothorax posticè obtusus, 5-articulatus, capite discreto. Antennæ anticæ latè divaricatæ, rectiusculæ, vix corporis longitudine, 7–8-articulatæ, articulis ultimis tribus brevibus, precedentibus longis; setis prælongis, penultimâ posticâ dimidio breviore quam apicales. Styli caudales oblongi, tenues.

Long. $\frac{1}{20}''$. — *Hab.* prope Patagoniam. — Lect. diebus 14, 15 Jan., 1839.

2. ACARTIA NEGLIGENS. — Gracillima. Frons triangulata. Cephalothorax angustus, posticè minutè apiculatus, capite fere discreto. Antennæ anticæ fere corporis longitudine, tenuissimæ, latissimè divaricatæ, apicibus fronte paulo anteriores, 7 – 9-articulatæ, articulis tribus ultimis brevibus; setis prælongis, posticâ penultimâ apicales æquante. Styli caudales tenuissimi, oblongi, setis latè divaricatis.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, prope insulas "Kingsmill," et lat. bor. 28°, long. orient. 171°. — Lect. diebus 15 Ap., et 17 Maii, 1841.

3. ACARTIA TONSA. — Frons rotundata. Cephalothorax posticè obtusus, 6-articulatus, capite discreto. Antennæ anticæ multiarticulatæ, rectæ, apicibus fronte non anteriores, setis plerumque brevibus, paucis longiusculis (3 – 4-articulos simul sumtos longitudine æquantibus). Styli caudales perbreves.

Long. $\frac{1}{18}''$. — *Hab.* in "Port Jackson" Novi-Hollandiæ. — Lect. Mar., 1840.

4. ACARTIA LAXA. — Gracilis. Frons rotundata. Cephalothorax 4-articulatus, capite non discreto, posticè longè acutus. Antennæ anticæ, rectiusculæ, corpore paulo longiores, nusquam fronte anteriores, multiarticulatæ, articulo primo longiore, setis longiusculis, valde inæquis. Abdomen breve. Styli caudales paulum oblongi, setis latissimè diffusis, abdomine non longioribus.

Long. $\frac{1}{15}''$. — *Hab.* in mari "Sulu," et freto "Banka." — Lect. diebus 2 Feb., et 2 Mar., 1842.

Genus IX. PONTELLA.

Rostrum furcatum. *Oculi* duo *superiores*, pigmentis sive coalitis sive remotis; duo *inferiores* coaliti. *Antennæ anticæ* multiarticulatæ, setis non diffusis, antennâ dextrâ *maris* geniculante. *Cephalo-*

thorax 4–7-articulatus, segmento cephalico sæpe discreto. *Maxillipedes* (ct. vi.) grandes, recti, setis longis, setulosis. *Pedes antici* (ct. vii.) minores. *Pes posticus* (ct. xii.) *dexter maris* crassus, prehensilis.

SYN. — Pontia, *Milne Edwards.** — Irenæus, *Goodsir.* — Broteas, *Lovén.*

I. PONTELLÆ CALANOIDEÆ. ANTENNÆ ANTICÆ DUPLO CURVATÆ, AD APICES FRONTE NON ANTERIORES. ANTENNÆ POSTICÆ, AD APICEM RAMI MINORIS, 3-SETIGERÆ.

1. PONTELLA ELLIPTICA. — *Feminæ :* Frons rotundata. Cephalothorax crassus, 4-articulatus, capite inermis, angulis posticis acutis, remotis. Oculi superiores remotiusculi, inferiores minuti. Antennæ anticæ duplo curvatæ, apicibus fronte valde posterioribus, corpore breviores, setis brevibus, subapicalibus perbrevibus, apicalibus vix articuli longitudine. Styli caudales oblongi, setis valde inæquis. (Cærulea, dorso sæpe argentea.)

Long. $\frac{1}{16}''$. — *Hab.* in freto "Banka." — Lect. die 2 Mar., 1842.

2. PONTELLA BRACHIATA. — *Maris :* Frons subtriangulata. Cephalothorax 6–7-articulatus anticè angustior, inermis, angulis posticis acutis, remotis. Oculi superiores remotiusculi aut coaliti. Antennæ anticæ corporis longitudine, duplo curvatæ, apicibus fronte non anterioribus, setis brevibus, posticâ penultimâ articulum longitudine fere duplo superante, anticâ apicali breviore, aliis apicalibus et subapicalibus brevioribus ; antenna dextra medio paulum incrassata, fere 23-articulata, duabus articulis medianis anticè unidentatis, articulo antepenultimum præcedente elongato, duplice. Pes posticus dexter maximus, digito elongato, rectè inflexo.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat aust. 42°, long. occ. 78° 45′; lect. die 3 Ap., 1839. In syrtis "Lagulhas"; lect. die 8 Ap., 1842. — *Feminæ* (an ejus speciei ?) frons vix triangulata; styli caudales divaricati; abdomen 3-articulatum (*maris* 4); anguli postici cephalothoracis divaricati. — Lect. in syrtis "Lagulhas" die 8 Ap., 1842.

II. ANTENNÆ ANTICÆ AD APICES FRONTE ANTERIORES.

A. *Caput lateribus inerme.*

1. Cephalothorax posticè obtusus aut brevissimè acutus.

3. PONTELLA PLUMATA. — *Feminæ :* Frons rotundata. Cephalo-

* *Pontia* Papilionum generis vocabulum, itaque *Pontella* hìc scripsa.

thorax curtus, obesus, 6-articulatus, capite discreto, segmento postico perbrevi, et posticè vix acuto. Antennæ anticæ corpore paulo longiores, latè divaricatæ, fere rectæ, setis raris sublongis, apicalibus articulo plus duplo longioribus, subapicalibus brevioribus. Antennæ posticæ ramos valde inæquæ, setis ramorum et palporum sequentium fere corporis longitudine, instar plumarum. Styli caudales parce oblongi.

Long. $\frac{1}{12}$. — *Hab.* in mari Atlantico, lat. bor. 5°, long. occ. 21°.

4. PONTELLA TURGIDA. — Frons rotundata. Cephalothorax crassus, obesus, 5 – 6 articulatus, capite discretus, posticè obtusus. Oculi superiores approximati. Antennæ anticæ corporis longitudine, fermè 21-articulatæ, 60° – 90° divaricatæ et prope medium obsoletè reflexæ ; setis brevibus, penultimâ posticâ longiore quam apicales aut aliæ subapicales. Antennæ posticæ ramos valde inæquæ, setis longis. Styli caudales oblongi. — *Maris* antenna antica dextra 10 – 12-articulata, articulo submediano latè subovato et apice acuto, articulis tribus sequentibus valde elongatis, ultimo triplice.

Long. $\frac{1}{24}''$. — *Hab.* in mari *Atlantico*, lat. bor. $8\frac{1}{2}$° – 0°, long. occ. 23° – 18° ; lect. diebus 15, 22, 23, 26 Oct., 1838. Lat. aust. 1° – $4\frac{1}{2}$°, long. occ. $17\frac{1}{2}$° – $21\frac{1}{2}$° ; lect. diebus 5, 6, 7 Nov., 1838. Lat. aust. 4° 30′, long. occ. 25° ; lect. die 13 Maii, 1842. Lat. bor. 0° 15′, long. occ. 31° ; lect. die 17 Maii, 1842. In mari *Pacifico* prope insulas " Kingsmill " ; lect. diebus 13, 28 Ap., 1841. In syrtis " Lagulhas " ; lect. die 8 Ap., 1842.

5. PONTELLA CURTA. — Frons rotundata. Cephalothorax curtus, crassiusculus, 5-articulatus, capite discreto, angulis posticis brevissimè acutis. Antennæ anticæ corpore breviores, rectæ, 105° divaricatæ, setis brevibus, apicali anticâ longiore. Antennæ posticæ ramos valde inæquæ, minore plus dimidio breviore. Styli caudales oblongi, non divaricati.

Long. $\frac{1}{20}''$. — *Hab.* prope insulam " Mindoro " et in freto " Sunda " ; lect. diebus 24 Jan. et 4 Mar., 1842. In syrtis " Lagulhas " ; lect. die 8 Ap., 1842.

6. PONTELLA CONTRACTA. — Frons rotundata. Cephalothorax 6 – 7-articulatus, capite discreto, angulis posticis brevissimè acutis, segmento postico fere obsoleto. Antennæ anticæ cephalothorace non longiores, 100° – 110° divaricatæ, rectæ, fermè 17-articulatæ, setis brevibus, apicali anticâ longiore. Rami antennarum posticarum valde inæqui. Styli caudales elongati. [Abdomen 2-articulatum.]

Long. $\frac{1}{18}''$. — *Hab.* in mari Pacifico, lat. aust. $18\frac{1}{4}$°, long. occ. 124°

30′; lect. die 7 Aug., 1839. An eadem species in mari Atlantico, lat. aust. 2°, long. occ. 20° ; lect. die 6 Nov., 1838.

7. PONTELLA MEDIA. — Frons rotundata. Cephalothorax 5-articulatus, segmento postico brevissimo et valde angusto, non acuto, capite vix discreto. Oculi superiores remotiusculi, inferiores parvuli. Antennæ anticæ corporis longitudine, duplo curvatæ, fere transversæ, apicibus fronte anteriores, setis brevibus, rectis, apicalibus articuli longitudine, posticâ penultimâ parce longiore, aliis subapicalibus brevioribus. Styli caudales oblongi. [Abdomen 2-articulatum.]

Long. $\frac{1}{20}''$. — *Hab.* in mari "Sulu"; lect. die 27 Jan., 1842.

8. PONTELLA CRISPATA. — *Feminæ:* Frons subtriangulata, obtusa. Cephalothorax 7-articulatus, segmento postico brevissimo, obtuso aut subacuto. Oculi superiores remotiusculi, inferiores mediocres. Antennæ anticæ vix corporis longitudine, latè divaricatæ, apicibus fronte valde anterioribus et prorsum curvatis; setis brevibus, prope basin confertis et paucis uncinatis, apicalibus et posticâ antepenultimâ articulo parce longioribus, posticâ penultimâ paulo longiore. Styli caudales parce oblongi, setis subæquis. [Abdomen 4-articulatum.]

Long. $\frac{1}{15}''$. — *Hab.* in mari *Pacifico*, prope insulas "Kingsmill"; lect. diebus 22, 26 Mar., 1841. In mari *Atlantico*, lat. bor. $8\frac{1}{2}°$, long. occ. 23° 45′; lect. die 15 Oct., 1838.

9. PONTELLA DETRUNCATA. — Frons obtusa. Cephalothorax 5–6-articulatus, capite discreto, angulis posticis rectè truncatis et extus brevissimè acutis. Antennæ anticæ 22–24-articulatæ, vix corporis longitudine, late divaricatæ, apicibus fronte valde anterioribus et prorsum curvatis; setis brevibus, rectis, posticâ penultimâ longiore quam apicales vel aliæ subapicales. Styli caudales breves. Antenna dextra *maris*, medio incrassata, subteres, 12–13-articulata, articulo tertio elongato, obsoletè articulato, septimo (octavo?) brevi et subtriangulato duabus sequentibus tenuibus, longis. Pes posticus dexter *maris* crassissimè cheliformis, manu subovatâ, pollice laterali, obtuso, dimidio breviore, digito elongato, tenui et curvato.

Long. $\frac{1}{12}''$ – $\frac{1}{16}''$. — *Hab.* in mari Pacifico, lat. aust. 26° 8′, long. occ. 178°; lect. die 18 Ap., 1840. Lat. aust. 5° 20′, long. orient. 175° 30′; lect. die 25 Mar., 1841: etiam prope insulas "Kingsmill."

10. PONTELLA SIMPLEX. — Frons obtusiuscula. Cephalothorax subgracilis, capite obsoletè discreto, segmento postico brevi et perangusto. Oculi superiores, subremoti, inferiores mediocres. Antennæ anticæ

cephalothorace breviores, 9-articulatæ, 100° divaricatæ ; setis totis brevibus. Styli caudales elongati. [Abdomen 2-articulatum. An specimen adultum ?]

Long. $\frac{1}{20}''$. — *Hab.* in mari Pacifico, lat. aust. 32° 24′, long. orient. 178°. — Lect. die 9 Ap., 1840.

11. PONTELLA EXIGUA. — Gracilis. Frons obtusa. Cephalothorax 6-articulatus, capite discreto, segmento postico brevi, obtuso. Oculi inferiores maximi, valde elongati, subclaviformi. Antennæ anticæ corpore valde breviores, 120° (?) divaricatæ, setis perbrevibus, apicali anticâ longiore, subapicalibus brevibus. Antennæ posticæ tenues, ramo majore plus duplo longiore. Styli caudales oblongi. [An adultum ? Abdomen 2-articulatum.]

Long. $\frac{1}{30}''$. — *Hab.* in mari Atlantico, lat. bor. $7\frac{1}{2}$° et $4\frac{3}{4}$°, long. occ. $23\frac{3}{4}$° et 19° ; lect. diebus 16, 24 Oct., 1838.

2. Cephalothorax posticè productus et acutus.

* *Seta antennarum anticarum apicalis setis subapicalibus brevior.*

12. PONTELLA AGILIS. — *Feminæ : P. crispatæ* antennas similis. Anguli postici cephalothoracis acuti, fronte rotundatâ. Setæ antennarum anticarum fere rectæ prope basin confertæ. — Forsan *P. crispatæ* cephalothorax interdum posticè acutus et species non differt.

Long. $\frac{1}{8}''$. — *Hab.* in mari Atlantico, lat. aust. $19\frac{1}{2}$°, long. occ. $38\frac{3}{4}$° ; lect. die 17 Nov., 1838 : etiam (?) lat. bor. $9\frac{1}{4}$°, long. occ. 24° 18′.

13. PONTELLA ACUTIFRONS. — *Maris : P. crispatæ* et *agili* similis. Anguli postici cephalothoracis acuti. Frons acuta et prominens ; rostro longissimè furcato et valde inflexo. Setæ antennarum anticarum rectæ, prope basin fere articuli secundi longitudine, posticâ penultimâ plus duplo longiore quam apicales. Antenna dextra medio incrassulata, subteres 12 – 13-articulata ; articulis secundo et quinto æquis, septimo brevissimo, octavo valde elongato, subattenuato, recto, fere duplo longiore quam nono ; nono ad apicem anticam instar spinæ valde producto ; articulis sequentibus (ultimis) tribus, normalibus. Pes posticus dexter latissimè cheliformis, manu subquadratâ, pollice breviter spiniformi, digito recto, apice minuto inflexo, valde breviore quam manus.

Long. $\frac{1}{7}''$. — *Hab.* in mari Pacifico, prope insulam "El Gran Cocal," lat. aust. 5° 40′, long. orient. 175° 30′ ; etiam prope insulas "Kingsmill" ; lect. diebus 25 Mar., 1 Ap., 1841.

14. PONTELLA ACUTA. — Frons longè acuta, rostro brevi, vix inflexo.

Cephalothorax 5-articulatus, capite discreto, angulis posticis elongatis, acutis. Oculi superiores remoti, inferiores parvi. Antennæ anticæ subtransversæ, fere corporis longitudine, fermè 21 – 22-articulatæ, apicibus fronte paulo anterioribus, et prorsum leviter curvatis, setis prope basin confertis longiusculis, posticâ penultimâ duplo longiore quam articulus, apicalibus et aliis subapicalibus brevioribus. Styli caudales oblongi. Antenna dextra *maris* subteres, fermè 13-articulata, articulo secundo longo, 6 sequentibus brevibus, proximis duobus elongatis et tenuibus, parce arcuatis, subæquis, 3 proximis (ultimis) normalibus. Pes posticus dexter *maris* latus, manu apice late orbiculatâ, pollice nullo, digito vix manus longitudine, paulum inflexo. [Cyanea. Abdomen 4-articulatum.]

Long. $\frac{1}{10}''$. — *Hab.* prope insulam "Mindoro"; lect. die 24 Jan., 1842. In mari Sinensi; lect. die 15 Feb., 1842.

† *Seta antennarum anticarum apicalis subapicalibus longior.*

15. PONTELLA RUBESCENS. — *Feminæ:* Frons rotundata. Cephalothorax 6-articulatus, capite discreto, segmento septimo obsoleto, angulis posticis acutis. Oculi superiores remoti; inferiores pigmentum bilobati. Antennæ anticæ fere 120° divaricatæ et rectæ; setis brevibus, apicali vix longiore quam articulus. Ramus major antennarum posticarum fere triplo longior. Styli caudales elongati, paralleli. [Abdomen 3-articulatum.]

Long. $\frac{1}{15}''$. — *Hab.* in mari Pacifico, prope insulam "Upolu"; lect. die 24 Feb., 1841. Prope insulam "El Gran Cocal"; lect. die 25 Mar., 1841.

16. PONTELLA EMERITA. — *Feminæ:* Crassa. Frons obtusa. Cephalothorax 6 – 7-articulatus, capite discreto, angulis posticis longè acutis, segmento postico brevi. Oculi superiores remoti. Antennæ anticæ cephalothorace vix longiores, fermè 100° divaricatæ, rectæ. Ramus major antennarum posticarum fere quadruplo longior. Styli caudales breves. [Abdomen 2-articulatum segmentis subæquis.]

Long. $\frac{1}{10}''$. — *Hab.* in mari prope Promontorium Bonæ Spei; lect. die 12 Ap., 1842.

17. PONTELLA REGALIS. — *Feminæ:* Crassissima. Frons rotundata. Cephalothorax 5 – 6-articulatus, angulis posticis longè acutis, capite discreto brevi. Oculi superiores remoti, inferiores parvi. Antennæ anticæ cephalothorace breviores, 100° – 110° divaricatæ, duplo leviter curvatæ. Ramus major antennarum posticarum quadruplo longior.

Styli caudales brevissimi. [Abdomen 2-articulatum, segmento secundo brevi.]

Long. $\frac{1}{7}''$. — *Hab.* in mari "Sulu"; lect. die 27 Jan., 1842.

18. Pontella perspicax. — Frons rotundata. Cephalothorax 6-articulatus, capite discreto, segmento postico non breviore, angulis posticis longè acutis. Oculi inferiores grandes et prorsum valde elongati. Antennæ anticæ corpore valde breviores, 100° – 110° divaricatæ, fermè 21-articulatæ, ante medium obsoletè flexæ. Styli caudales elongati. Antenna antica dextra *maris* 9 – 10-articulata, articulo quarto lato, subovato. Pes posticus dexter vix crassus; manu angustâ, breviusculâ, digito vix longiore acuminato, pollice setiformi, longissimo, reflexo. [Abdomen 5-articulatum.]

Long. $\frac{1}{12}''$. — *Hab.* in mari Atlantico, lat. aust. 0° 40′, long. occ. 18°; lect. die 3 Nov., 1838. Forsan, lat. bor. 7° 25′, long. occ. 20°; lect. die 17 Oct., 1838.

19. Pontella strenua. — *Maris :* Frons acutiuscula. Cephalothorax 5 – 6-articulatus, angulis posticis longe acutis, capite discreto. Oculi superiores remoti, inferiores mediocres. Antennæ anticæ fere corporis longitudine, 80° – 90° divaricatæ, 17 – 18 articulatæ, ad medium obsoletè flexæ. Ramus major antennarum posticarum fere triplo longior. Styli caudales breves. Antenna antica dextra *maris* 12 – 14-articulata, articulo mediano subovato, apice antico acuto. Pes posticus dexter crassiusculus, manu ovali, breviore quam carpus, pollice tenuissimo, acuto, parcè longiore, digito mediocri, subulato, rectiusculo. [Abdomen 5-articulatum.]

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat. aust. 3°, long. orient. 175°.

20. Pontella protensa. — *Maris :* Crassa. Frons rotundata. Cephalothorax 5 – 6-articulatus, capite discreto, brevi, angulis posticis longè acutis. Oculi superiores remoti, inferiores mediocres. Antennæ anticæ basi vix 60° divaricatæ et medio fere 70°. Ramus antennarum posticarum major plus quadruplo longior. Styli caudales oblongi. Antenna *maris* antica dextra *P. strenuæ* similis. [Abdomen 5-articulatum.]

Long. $\frac{1}{16}''$. — *Hab.* in fretis "Banka" et "Sunda"; lect. diebus 1, 4 Mar., 1842.

B. *Caput lateribus armatum.*

21. Pontella hebes. — *Feminæ :* Frons truncata. Cephalothorax 4-articulatus, posticè rotundatus. Oculi superiores disjuncti, infe-

riores parvi. Antennæ anticæ fere corporis longitudine, transversæ, apicibus fronte paulo anterioribus, prorsum parce curvatis, prope basin setis confertis longiusculis, et unâ sublongâ mobili. Setis apicalibus articuli longitudine, posticâ penultimâ paulo longiore, aliis subapicalibus brevibus. Styli caudales vix oblongi. [Abdomen 3-articulatum.]

Long. $\frac{1}{16}''$. — *Hab.* prope insulam "Sumatra"; lect. die 3 Mar., 1842.

22. PONTELLA FRIVOLA. — *Feminæ P. hebetis* similis. Sed cephalothorax posticè acutus; abdomen 4-articulatum. An species differt? — *Long.* $\frac{1}{16}''$. *Hab.* prope insulam "Sumatra"; lect. die 3 Mar., 1842.

Maris (an hæc species?) antenna antica dextra 9-articulata, subteres, incrassulata, articulis 2, 3, 4, 5, 6 totis longis, 3 sequentibus (ultimis) normalibus, articulo quarto longiore et crassiore, subcylindrico. Antennæ posticæ tenuissimæ, ramis fere æquis. Abdomen 4-articulatum, tenue; stylis parce oblongis. Anguli postici cephalothoracis acuti, dextro longiore. — *Long.* $\frac{1}{12}''$. *Hab.* in mari "Sulu"; lect. die 28 Jan., 1842.

23. PONTELLA DETONSA. — Caput discretum, subtriangulatum, fronte obtusiusculâ. Cephalothorax 7-articulatus, segmento septimo brevissimo, posticè obtuso aut obtusiusculo. Oculi superiores remoti, inferiores subgrandes, vix elongati. Antennæ anticæ cephalothorace breviores, rectæ, fere 100° divaricatæ, 20–22-articulatæ, setis totis perbrevibus. Styli caudales elongati, vix divaricati. Antenna dextra *maris* paululum incrassata, teretiuscula, fermè 20-articulata. [Cyanea; interdum dorso margaritacea. Abdomen 3-articulatum.]

Long. $\frac{1}{8}''-\frac{1}{15}''$. — *Hab.* in mari Pacifico, lat. aust. 18° 10′, long. occ. 125° 20′; lect. die 8 Aug., 1839. Lat. aust. 12° 45′, long. occ. 171°; lect. die 5 Feb., 1841. Lat. aust. 11°, long. occ. 170°; lect. die 1 Feb., 1841. Lat. aust. 5° 30′, long. orient. 175° 50′, prope insulam "El Gran Cocal"; lect. die 25 Mar., 1841. Prope insulam "Mindoro"; lect. die 24 Jan., 1842.

24. PONTELLA ARGENTEA. — Caput discretum, subtriangulatum, fronte obtusum. Cephalothorax 5 (–6)-articulatus, posticè brevissimè acutus articulis tribus posticis subæquis. Oculi superiores remoti, inferiores subgrandes non elongati. Antennæ anticæ cephalothorace breviores, fere 90° divaricatæ et levissimè incurvatæ, 18–20-articulatæ, setis totis perbrevibus, duabus apicalibus subuncinatis. Styli caudales parce oblongi. [Viridescens, dorso argentea. Abdomen 3-articulatum.]

Long. $\frac{1}{12}''$. — *Hab.* in mari Atlantico, lat. aust. 40° 35′, long. occ. 60°, prope "Rio Negro." — Lect. die 24 Jan., 1839.

25. PONTELLA SPECIOSA. — Caput discretum, subtriangulatum, fronte obtusum. Cephalothorax 5–7-articulatus, posticè acutus aut obtusiusculus. Oculi superiores remoti, inferiores mediocres. Antennæ anticæ cephalothoracis longitudine, fere rectæ, prope 110° divaricatæ, 21–22-articulatæ; setis brevibus, apicali anticâ et penultimâ posticâ longioribus, articulum paulo superantibus. Styli caudales oblongi. Antenna dextra *maris* pauci-articulata, articulo quinto latè ovato. Pes posticus dexter *maris* crassus, manu latâ apice truncatâ et obtusè dentatâ, pollice e basi manus producto, elongato, spiniformi, digito prælongo, incurvato. [*Maris* cephalothorax 6-articulatus, et abdomen 4-articulatum; color viridis, dorso argenteus. *Feminæ* cephalothorax 7-articulatus, segmento ultimo brevissimo; abdomen 3-articulatum; color ochreus, medio lætè ruber.]

Long. $\frac{1}{12}''$. — *Hab.* prope fretum Sundæ; lect. die 4 Mar., 1842.

26. PONTELLA PRINCEPS. — *Feminæ:* Caput discretum, subtriangulatum, fronte obtusiusculum. Cephalothorax 6-articulatum, posticè longè acutus, articulis tribus posticis subæquis. Oculi superiores remoti; inferiores mediocres parce elongati. Antennæ anticæ cephalothorace parce breviores, rectiusculæ, fermè 110° divaricatæ, setis brevibus, apicali anticâ longiore. Styli caudales perbreves. [Cyanea, dorso margaritacea. Abdomen 4-articulatum, distortum.]

Long. $\frac{1}{4}''$. — *Hab.* in mari Pacifico, prope insulam "Tongatabu"; lect. die 29 Mar., 1840.

27. PONTELLA FERA. — Caput vix discretum, subtriangulatum, fronte rotundatum. Cephalothorax 6–7-articulatus, posticè obtusus aut obtusiusculus, segmento postico brevissimo. Oculi superiores remoti, inferiores grandes, non elongati. Antennæ anticæ vix cephalothoracis longitudine, fermè 21-articulatæ, 130° divaricatæ, setis prope basin sublongis, confertis, aliis brevibus, apicali anticâ et penultimâ posticâ articulo vix longiore. Styli caudales elongati, divaricati. Antenna antica dextra *maris* subteres 11–12-articulata, articulo secundo longo, tertio brevissimo, quarto sub quintum producto, proximo spinam inversam ferente. Pes posticus dexter *maris* tenuis, manu subcylindricâ, digito tenuissimo, ad apicem spatulato et concavo.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat. aust. 11° – 12° 45′, long. occ. 170° – 171°; lect. diebus 1, 5 Feb., 1840.

Familia IV. CORYCÆIDÆ.

Oculi duo grandes plus minusve remoti, lenticulis duabus prolatis maximis, et corneis oblatis instar conspicillorum, constructi; quoque duo oculi connati minutissimi. *Antennæ anticæ* pauci-articulatæ, simplicissimæ. *Antennæ posticæ* simplicissimæ. *Pedes mandibulares maxillaresque* brevissimi. *Sacculi ovigeri* duo.

Genus I. CORYCÆUS.

Corpus crassum, anticè rotundatum. *Conspicilla* fronte affixa. *Antennæ posticæ* pedibus anticis majores. *Pedes antici* sexu vix dissimiles digito subuncinato tenuique confecti. *Abdomen* pauci-articulatum, appendicibus basi nullis, stylis caudæ styliformibus.

1. Antennæ Posticæ macrodactylæ, digito non breviore quam carpus.*

A. *Setæ caudales stylis valde breviores.* [*Cephalothorax posticè (ad segmentum tertium) acutus, segmento quarto minore.*]

1. Corycæus gracilis. — Cephalothorax gracilis, ventre non carinato. Antennæ anticæ breviter setulosæ. Conspicilla fere contigua. Antennarum posticarum carpus digito brevior, setâ longâ, setulosâ. Abdomen uni-articulatum, apice subcylindrico fere triplo longius, basi angustum. Styli caudales abdomine breviores, setis brevissimis.

Long. $\frac{1}{30}''$. — *Hab.* in mari Atlantico, lat. bor. 1° 30′, long. occ. 18° 20′, et lat. aust. 2° 20′, long. occ. 20°.

2. Corycæus decurtatus. — Cephalothorax ventre carinatus. Antennæ anticæ breviter setulosæ. Conspicilla fere contigua. Antennarum posticarum carpus digito brevior setâ nudâ elongatâ, etiam setâ alterâ setulosâ breviore. Abdomen basi crassum, apice subcylindrico fere quadruplo longius. Styli caudales vix dimidii abdominis longitudine, setis brevissimis.

Hab. in mari Pacifico, prope insulam "Duke of Clarence."

3. Corycæus deplumatus. — Conspicilla remotiuscula. Antennæ anticæ brevissimè setulosæ, 7-articulatæ. Antennarum posticarum car-

* *Carpus* est articulus elongatus antennarum posticarum secundus (aut primus et secundus simul sumti). *Digitus* articulis tertio quartoque compositus, plus minusve discretis. Carpus setâ longâ sive nudâ sive setulosâ ad basin ornatus, et sæpe unâ duabusve lateralibus aut apicalibus.

pus digito brevior, setâ setulosâ longâ, et aliâ nudâ. Abdomen uni-articulatum, tenue. Styli caudales vix dimidii abdominis longitudine ; setis plus dimidio brevioribus.

Hab. in mari Atlantico, lat. bor. 9° 20′, long. occ. 24° 15′.

4. CORYCÆUS VARIUS. — Cephalothorax crassus. Conspicilla remotiuscula. Antennæ anticæ longè setulosæ. Antennarum posticarum carpus digito brevior, setâ longâ, nudâ. Abdomen 2-articulatum, segmento secundo cylindrico, breviore quam primum. Styli caudales abdomine paulo breviores, setis dimidio brevioribus.

Long. $\frac{1}{20}''$. — *Hab.* in mari Atlantico, lat. bor. 7° 25′, long. occ. 22° ; lat. aust. 1° - 7°, long. occ. 18° - 21°. In mari Pacifico, lat. aust. 15° 30′, long. occ. 138° 30′ ; lat. aust. 33°, long. orient. 153° 30′, prope Australiam ; quoque prope insulas " Ladrones."

5. CORYCÆUS LONGISTYLIS. — Cephalothorax crassus. Conspicilla remotiuscula. Antennæ anticæ longè setulosæ. Antennarum posticarum carpus digito vix brevior, ad apicem internum dentiformis, nudus et acutus, setâ basali longâ, nudâ ; digito setam nudam ad basin ferente. Abdomen uni-articulatum, dimidio apicali cylindrico. Styli caudales tenues, abdomine valde longiores, setis perbrevibus.

Long. $\frac{1}{10}''$. — *Hab.* in mari Sinensi.

B. *Setæ caudales stylis non valde breviores, sæpe longiores.*

* Cephalothorax posticè obtusus.

6. CORYCÆUS OBTUSUS. — Conspicilla lata. Antennæ anticæ tenues, setis longiusculis. Antennarum posticarum carpus digito non brevior, setâ longâ nudâ. Abdomen 2-articulatum, subtus ad basin apiculatum, segmento secundo dimidium primi longitudine superante. Styli caudales dimidii abdominis longitudine, setis stylo parce longioribus.

Long. $\frac{1}{30}''$. — *Hab.* in mari Pacifico, prope insulam " El Gran Cocal."

† Cephalothorax posticè acutus.

7. CORYCÆUS CRASSIUSCULUS. — Cephalothorax crassiusculus, segmento quarto posticè subacuto. Conspicilla contigua. Antennarum posticarum carpus digito vix brevior, setâ nudâ. Abdomen uni-articulatum, apice subcylindrico fere dimidio breviore quam pars basalis elliptica. Styli caudales dimidium abdominis longitudine superantes, setis paulo longioribus.

Long. $\frac{1}{20}''$. — *Hab.* in mari " Sulu," prope insulam " Panay."

8. CORYCÆUS LATICEPS. — Cephalothorax crassus, segmento quarto breviter acuto. Conspicilla remotiuscula. Antennæ anticæ 7-articulatæ, setis dimidio brevioribus. Antennarum posticarum carpus digito paulo brevior, setâ longâ, nudâ. Abdomen 2-articulatum; segmento secundo cylindrico, dimidio breviore. Styli caudales dimidio abdominis breviores, setis parce longioribus.

Long. $\frac{1}{20}''$. — *Hab.* in mari Atlantico, lat. bor. 4° – 5°, long. occ. 19° – 22°, et lat. aust. 0° 15′ – 1°, long. occ. 18° 30′, et 31°.

9. CORYCÆUS VITREUS. — Cephalothorax crassus, segmento quarto brevissimè acuto. Conspicilla remotiuscula. Antennæ anticæ longè setulosæ. Antennarum posticarum carpus digito vix brevior, setâ nudâ, longâ. Abdomen 2-articulatum, apice cylindrico brevi. Styli caudales dimidii abdominis longitudine, setis stylos paulum superantibus.

Long. $\frac{1}{15}''$. — *Hab.* in mari Pacifico, lat. aust. 18°, long. occ. 124° 30′.

10. CORYCÆUS AGILIS. — Cephalothorax crassiusculus, segmento quarto subrectangulato. Conspicilla remotiuscula. Antennæ anticæ breviter setulosæ. Antennarum posticarum carpus digito paulo brevior, setâ longâ, nudâ. Abdomen 2-articulatum, crassum, segmento secundo tenuiter subcylindrico, paulo breviore quam primum. Styli caudales tenuissimi, dimidio abdominis longiores, setâ paulo breviore.

Long. $\frac{1}{30}''$. — *Hab.* in mari Pacifico, prope insulam "Tongatabu."

11. CORYCÆUS ORIENTALIS. — Cephalothorax crassus, segmento quarto rectangulato, subacuto. Conspicilla remota. Antennæ anticæ breviter setulosæ. Antennarum posticarum carpus digito paulo longior, setâ longâ, nudâ, digito articulis duabus subæquis composito. Abdomen 2-articulatum, ad basin infra rectangulatum. Styli caudales breves, setis vix longioribus.

Long. $\frac{1}{20}''$. — *Hab.* in mari "Sulu," prope insulam "Panay."

2. ANTENNÆ POSTICÆ MICRODACTYLÆ, DIGITUS CARPO BREVIOR.

A. *Seta carpi antennarum posticarum nuda.*

* Styli caudales abdomine non breviores.

Digitus carpo paulo brevior.

12. CORYCÆUS LAUTUS. — Cephalothorax ad segmentum quartum obtusus. Conspicilla remotiuscula. Antennæ anticæ longissimè setulosæ. Antennarum posticarum carpus digito paulo longior, setâ longâ, nudâ, digito subæquè 2-articulato, et ad basin setam nudam longam fe-

rente. Abdomen 2-articulatum, segmentis fere æquis. Styli caudales tenuissimi, abdomine valde longiores, setis perbrevibus.

Long. $\frac{1}{15}''$. — *Hab.* in mari Pacifico, prope insulas "Kingsmill."

Digitus carpo valde brevior, uncinatus.

13. Corycæus speciosus. — Cephalothorax ad segmentum quartum longè acutus. Conspicilla non contigua. Antennæ anticæ setis longissimæ. Abdomen 2-articulatum, articulo primo crasso, secundo cylindrico, dimidio breviore. Styli caudales abdomine longiores, divaricati, setis brevibus. [Pedes biremes 4 posteriores utrinque protensi.]

Long. $\frac{1}{16}''$. — *Hab.* in mari Atlantico, lat. bor. 5° – 7°, long. occ. 21° – 22°.

14. Corycæus remiger. — Cephalothorax ad segmentum quartum longè acutus. Conspicilla remota, parvula. Antennæ anticæ setis longissimæ. Abdomen 3-articulatum, segmento ultimo subito angustiore, cylindrico. Styli caudales fermè abdominis longitudine, divaricatæ, setis stylo paulo brevioribus. (*C. specioso* pedes biremes similis.)

Long. $\frac{1}{15}''$. — *Hab.* in mari Atlantico, lat. aust. 11°, long. occ. 29°.

† Styli caudales abdomine breviores. [Cephalothorax posticè (ad segmentum tertium) longè acutus.]

15. Corycæus latus. — Cephalothorax crassus, segmento quarto posticè longè acuto. Conspicilla remota. Antennæ anticæ mediocriter setigeræ. Abdomen crassum, posticè attenuatum, segmento ultimo subcylindrico. Styli caudales dimidio abdominis breviores, divaricati, setis paulo longioribus.

Long. $\frac{1}{24}''$. — *Hab.* in mari Atlantico, lat. bor. 3° 45′ – 4° 20′, long. occ. 19° 30′ – 18° 30′ ; etiam lat. aust. 6° 20′, long. occ. 24°.

16. Corycæus venustus. — Cephalothorax mediocris, segmento quarto breviter acuto. Conspicilla remotiuscula. Antennæ anticæ longè setigeræ. Antennarum posticarum carpus digito fere duplo longior, apice interno dentiformi, setâ longâ, nudâ, digito subæque 2-articulato. Abdomen 2-articulatum, segmento primo paulo latiore et longiore. Styli caudales abdomine paulo breviores, divaricatæ, setis abdominis longitudine.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, prope insulas "Kingsmill."

B. *Seta carpi antennarum posticarum setulosa.* [*Cephalothorax posticè longè acutus.*]

17. Corycæus pellucidus. — Cephalothorax gracilis, ventre max-

imè carinato. Conspicilla fere contigua. Antennæ anticæ 7-articulatæ, setis fere brevibus. Antennarum posticarum carpus ad apicem internum apiculatus, digito brevi. Abdomen 1-articulatum, apice obliquè truncato. Styli caudales dimidio abdominis longiores, setis vix majoribus.

Long. $\frac{1}{25}''$. — *Hab.* in mari Atlantico, lat. bor. 4° – 7°, long. occ. 19° 30′ – 21° 30′; quoque lat. aust. 2° 20′, long. occ. 20°.

18. Corycæus concinnus. — *C. pellucido* similis. Cephalothorax paulo crassior; abdomen gracilius; styli breviores, dimidium abdominis longitudine non superantes. Antennæ anticæ 3-articulatæ.

Long. $\frac{1}{25}''$. — *Hab.* in mari Pacifico, lat. aust. 15° 35′, long. occ. 138° 30′; quoque leucas 80 ab insulâ " Tongatabu " versus austrum.

19. Corycæus productus. — Antennæ anticæ 5 – 7-articulatæ, brevissimè setulosæ. Antennarum posticarum carpus ad apicem acutus, et digitus brevis, 3-articulatus. Abdomen elongatum, ad apicem oblique non truncatum. Styli caudales dimidio breviores, setis stylo paulo longioribus.

Long. $\frac{1}{30}''$. — *Hab.* in mari Atlantico, lat. bor. 8° 35′, long. occ. 23° 40′.

20. Corycæus longicaudatus. — Cephalothorax mediocris, segmento quarto longè acuto. Conspicilla fere contigua. Antennæ anticæ 7-articulatæ, setis longiusculis, antennâ brevioribus. Antennarum posticarum carpus ad apicem internum acutus, et digitus parvulus, 3-articulatus. Abdomen mediocre, subellipticum. Styli caudales longiores, setis dimidio brevioribus.

Long. $\frac{1}{18}''$. — *Hab.* in mari Atlantico, lat. bor. 5° – 0° 50′, long. occ. 18° – 20°; quoque lat. aust. 2° 20′, long. occ. 20°.

Genus II. ANTARIA.

Corpus crassum, anticè rotundatum. *Conspicilla* fronte affixa. *Antennæ posticæ* parvæ, ad apicem breviter setigeræ, pedibus anticis (ct. vii.) non majores, carpo posticè angulato. *Pedes antici* sexu vix dissimiles (?), digito tenui subuncinato. *Abdomen* pauci-articulatum. [Cephalothorax posticè obtusus.]

1. Antaria crassimana. — Pedes antici pervalidi, antennis posticis valde majores, articulo secundo abdomen longitudine fere æquante. Abdomen 3-articulatum, segmentis primo tertioque perbrevibus. Styli caudales abdomine triplo et setæ duplo breviores.

Long. $\frac{1}{30}''$. — *Hab.* in mari Atlantico, lat. bor. 1°, long. aust. 18°.

2. ANTARIA GRACILIS. — Conspicilla remota. Pedes antici mediocres, antennis posticis paululo majores. Abdomen sensim attenuatum. Styli caudales abdomine quadruplo breviores, setis dimidio abdominis longioribus.

Long. $\frac{1}{20}''$. — *Hab.* in mari Atlantico, lat. bor. 5° – 7°, long. occ. 21° – 22° ; lat. aust. 2° 20′, long. occ. 20°.

3. ANTARIA OBTUSA. — Conspicilla remota, parvula. Pedes antici parvuli, antennis posticis paululo majores. Abdomen sensim attenuatum, apice obsoletè 3-articulatum. Styli caudales dimidio abdominis paulo breviores, setis longiores. Cephalothorax posticè rotundatus.

Long. $\frac{1}{20}''$. — *Hab.* in mari " Sulu," prope insulam " Panay."

Genus III. COPILIA.

Corpus depressum, fronte latè quadratum, et conspicilla ad angulos anticos gerens. *Antennæ posticæ* digitiformes, digito elongato, subulato. *Abdomen* pauci-articulatum appendicibus ad basin nullis.

1. COPILIA MIRABILIS. — Cephalothorax fronte latus, parce excavatus posticè paulo latior, segmentis posticis latere obtusis, posticè ad apicem dorsalem spinigero. Antennæ posticæ ad articulum primum setulosæ, digito longo. Abdomen tenue, cephalothoracis dimidio brevius, obsoletè 5-articulatum. Styli abdomine longiores, tenuissimi.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, prope insulas " Kingsmill."

2. COPILIA QUADRATA. — Cephalothorax anticè bene quadratus, fronte parce excavatus, segmentis latere obtusis, postico brevissimo. Abdomen 4-articulatum, tenue, segmentis secundo tertioque non longioribus quam primum, quarto dimidium abdominis longitudine superante et lateribus parce excavato. Styli abdomine longiores, tenuissimi.

Hab. in mari Pacifico, lat. aust. 15° 20′, long. occ. 148° ; quoque lat. bor., prope long. orient. 165°.

Genus IV. SAPPHIRINA.

Corpus depressum. *Sexus* antennas posticas stylosque caudales similes, et abdomen, pedesque antici (*vel* maxillipedes, ct. vii.) dissimiles. *Antennæ posticæ* pediformes, digito tenui, 2-articulato, ad apicem unguiculato. *Abdomen feminæ* 5 – 6-articulatum, thorace subito angustius, appendices breves ad basin latere gerens ; *maris* 4 – 5-articulatum, thorace subito non angustius, appendicibus nullis.

Pedes antici maris digitum elongati, *feminæ* breves. *Styli* caudales laminati. — *Mares* sæpe lætè opalini aut fulgidè metallini, interdum cærulei. *Feminæ* sæpius incoloratæ, plus minusve pellucidæ ; interdum opacæ et azuleæ.

1. *Conspicilla conjuncta.*

1. SAPPHIRINA IRIS. — Antennæ posticæ abbreviatæ, digito dimidii carpi longitudine. Lamellæ caudales tenuiter falciformes, divaricati ; setis tribus, duabus apicalibus dimidio styli longioribus, alterâ externâ. — *Feminæ:* Corpus gracillimum valde elongatum (latitudine maximâ plus quintuplo longius). Conspicilla fronte insita. Abdomen 6-articulatum, segmento primo sequentibus vix angustiore. *Maris:* Corpus lineari-ellipticum, anticè rotundatum. Conspicilla inferiora, fronte remotiuscula.

Long. $\frac{1}{3}''$. — *Hab.* in mari Pacifico, lat. aust. 41°, long. occ. 76° 24′.

2. SAPPHIRINA ANGUSTA. — Digitus antennarum posticarum carpo valde (non duplo) brevior. Lamellæ caudales elongatæ, subovatæ, ad apicem internum prominulo, subacuto ; setis quatuor, duabus apicalibus dimidio lamellæ brevioribus, aliis duabus externis brevioribus. — *Feminæ:* Corpus valde elongatum (latitudine maximâ fere quadruplo longius). Conspicilla fronte insita. Abdomen 6-articulatum, segmento primo angustiore, tertio, quarto, quintoque lunatis et latus acutis, primo secundoque fere æquis.

Long. $\frac{1}{8}''$. — *Hab.* in mari Pacifico, lat. aust. 43°, long. occ. 78° 45′; etiam ad syrtas " Lagullas," lat. aust. 35° 50′, long. orient. 23°.

3. SAPPHIRINA ELONGATA. — Digitus antennarum posticarum tenuis, dimidio brevior quam carpus. Lamellæ caudales latæ, breviter ovatæ, apice interno vix prominulo, setis quatuor, totis dimidio lamellæ breviores. — *Feminæ:* Corpus angustè elongatum, valde convexum. Conspicilla fronte insita. Abdomen 5-articulatum, segmento primo parvulo, secundo majore sed valde minore quam sequens, sublunato.

Long. $\frac{1}{10}''$. — *Hab.* in mari Pacifico, lat. bor. 15°, long. orient. 179°.

4. SAPPHIRINA METALLINA. — Lamellæ caudales fere rectangulatæ, apice subtruncatæ, setis quatuor apicalibus subæquis, parcè brevioribus quam lamellæ.— *Maris:* Corpus valde depressum, angustato-ellipticum, 9-articulatum, segmento ultimo tecto, primo oblongo, quarto dimidio breviore quam quintum.

Long. $\frac{1}{10}''$. — *Hab.* in mari Pacifico, prope insulas " Kingsmill."

5. SAPPHIRINA CORUSCANS. — Digitus antennarum posticarum paulo

brevior quam carpus, tenuis, unguiculo elongato. Lamellæ caudales subovatæ, ad apicem rotundatæ, apice interno setam brevem gerente, setis aliis quatuor, totis brevibus (lamellâ fere quadruplo brevioribus). — *Maris :* Corpus depressum, elongato-ovatum, posticè angustatum, segmento primo (fere duplice) parce oblongo, aliis segmentis fere similibus. Conspicilla fronte insita, prominentia.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, lat. aust. 18° 10′, long. occ. 125° 30′.

6. Sapphirina inæqualis. — Digitus antennarum posticarum carpo non brevior, tenuis, unguiculo brevi. Lamellæ caudales oblongæ, subovatæ, apice interno prominulo, subacuto, setis quatuor, setis dimidio lamellæ non longioribus. — *Feminæ :* Corpus longè ovatum, segmentis cephalothoracis tribus ultimis dissimilibus, segmento ultimo breviore et latere acuto, penultimo obtuso. Conspicilla fronte insita. Abdomen 6-articulatum, segmento primo fere obsoleto aut tecto, secundo posticè acuto.

Long. $\frac{1}{12}''$. — *Hab.* in mari Pacifico, lat. aust. 43°, long. occ. 78° 45′.

7. Sapphirina ovata. — Digitus antennarum posticarum fermè longitudine carpi, articulis duabus digiti subæquis. Lamellæ caudales graciles, lanceolatæ, parce divaricatæ ; setis 4 – 5, unâ internâ, unâ aut duabus apicalibus, et aliis duabus externis, totis dimidio lamellæ valde brevioribus. — *Feminæ :* Corpus valde depressum. Cephalothorax ovatus, segmento antico paulo oblongo, segmentis duobus ultimis latere rotundatis, ultimo angustiore. Conspicilla fronte insita. Abdomen elongato-ellipticum, 5-articulatum, segmento primo non angustiore. — Rubescens.

Long. $\frac{1}{12}''$. — *Hab.* in freto "Balabac," prope insulam "Borneo."

8. Sapphirina splendens. — Digitus antennarum posticarum tenuis, carpo vix brevior. Lamellæ caudales ovato-rotundatæ, apice interno acuto ; setis quatuor, duabus apicalibus dimidio lamellæ non longioribus, aliis externis. — *Maris :* Corpus valde depressum, ovatum. Conspicilla fronte insita. Segmento primo (vix duplice) transverso, aliis longitudine subæquis, latere obtusis.

Long. $\frac{1}{15}''$. — *Hab.* in mari Pacifico, prope insulam "Assumption," lat. bor. 19° 30′, long. orient. 144° 30′.

9. Sapphirina ovalis. — Digitus antennarum posticarum crassus, carpo fere longior, articulis digiti valde inæquis, unguiculo dimidium digiti longitudine æquante. Lamellæ caudales ovatæ, setis quinque, unâ

internâ, duabus apicalibus, et aliis externis, totis paulo brevioribus quam lamellæ. — *Feminæ :* Corpus valde convexum. Cephalothorax ellipticus, 5-articulatus, segmento antico non oblongo, postico parvo. Conspicilla fronte insita. Abdomen 5-articulatum, segmento primo minore, latere truncato, tertio quartoque lunatis. — Opaca, azulea.

Hab. in mari Pacifico, prope insulam "Tongatabu," versus Austrum.

10. Sapphirina detonsa. — Digitus antennarum posticarum tenuis, carpo paulo brevior, unguiculo dimidii digiti longitudine. Lamellæ caudales approximatæ, subovatæ, latitudine plus duplo longiores, setis brevissimis (obsolescentibus). — *Feminæ :* Corpus valde convexum. Cephalothorax ellipticus, 5-articulatus, segmento primo non oblongo, aliis latera obtusis. Conspicilla fronte insita. Abdomen 5-articulatum, segmento primo fere obsoleto aut tecto, secundo latere obtuso, tertio quartoque lunatis. — Translucens, brunnescens.

Long. $\frac{1}{15}''$. — *Hab.* in mari Pacifico, lat. aust. 15°, long. occ. 138° 45′.

11. Sapphirina indigotica. — Digitus antennarum posticarum tenuis, fere carpi longitudine, et unguiculo fere dimidii digiti. Lamellæ caudales subovatæ, apice interno vix prominulo, setis quatuor, duabus apicalibus, aliis externis, totis dimidio lamellæ vix brevioribus. — *Feminæ :* Corpus valde convexum. Cephalothorax ellipticus. Conspicilla fronte insita. Abdomen 6-articulatum, segmento primo parvulo, tertio, quarto, quintoque lunatis. — Opaca, et azulea.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, lat. bor. 28°, long. orient. 177°.

12. Sapphirina orientalis. — Digitus antennarum posticarum tenuis, fermè carpi longitudine, unguiculo minus dimidio digiti. Lamellæ caudales breviter ovatæ, prope apicem internum dente acuto armatæ, setis quatuor, duabus apicalibus, aliis externis, totis brevibus, vix dimidii lamellæ longitudine. — *Maris :* Corpus valde depressum, subovatum, 10-articulatum, segmento antico latiore et paulo transverso, aliis sensim angustioribus. Conspicilla fronte insita. — *Feminæ* (?) : Corpus convexum. Cephalothorax ellipticus, 5-articulatus, segmento antico non transverso, postico ad latus truncato, angulis posticis acutis. Conspicilla fronte insita. Abdomen 6-articulatum, segmento primo minore, lateribus truncatis, secundo lateribus rotundatis, tribus sequentibus lunatis. — *Maris* color, opalinus ; *feminæ* indigoticus, opacus.

Long. $\frac{1}{10}''$. — *Hab.* in mari "Sulu."

2. *Conspicilla non contigua.*

13. Sapphirina ovato-lanceolata. — Digitus antennarum posticarum dimidio carpi paulo longior, articulis duabus digiti valde inæquis. Lamellæ caudales latitudine duplo longiores, non divaricatæ, setis quinque, totis brevibus, unâ brevissimâ ad apicem internum insitâ. — *Maris :* Corpus ovato-lanceolatum, 10-articulatum, segmento antico vix oblongo, tribus penultimis lunatis et latera subacutis aut obtusis. Conspicilla subremota, inferiora, et fronte remota. Splendidè opalina. *Long.* $\frac{1}{7}''$. — *Feminæ :* Corpus ovato-lanceolatum, abdomine (articulo primo brevissimo excluso) vix angustiore. Cephalothorax 4-articulatus, segmento antico fere duplice, aliis inter sese similibus, latere obtusis. Conspicilla remotiuscula, fronte insita. Abdominis segmenta secundum tertium quartumque latè sublunata ea latere subacuta. — Vix diaphana. — *Long.* $\frac{1}{16}''$.

Hab. in mari Atlantico, prope " Rio de Janeiro " ; quoque lat. aust. 23°, long. occ. 41°.

14. Sapphirina gemma. — Digitus antennarum posticarum carpo parce brevior, tenuis, articulis duabus digiti valde inæquis, unguiculo brevi. Lamellæ caudales subellipticæ, latitudine duplo longiores, ad apicem internum minutè apiculato, setis quatuor, brevibus, duabus apicalibus, aliis externis. — *Feminæ :* Corpus gracillimum, elongatum. Cephalothorax 5-articulatus articulatione primâ fere obsoletâ, segmento antico parce oblongo, posticis inter sese similibus, sensim minoribus. Abdomen valde angustius, 6-articulatum, segmentis primo secundoque subæquis, sequentibus vix lunatis. Conspicilla remotiuscula, inferiora, prope frontem insita. — *Maris :* Corpus oblongo-subellipticum 10-articulatum, segmento antico paulo transverso, posticis ad latis non acutis. Conspicilla remotiuscula, inferiora et fronte remota. — Color *maris* opalinus et flammeus ; *feminæ* nullus, sacculorum pallidè cyaneus.

Long. $\frac{1}{8}''$. — *Hab.* in mari Australis, ad syrtas " Lagullas." — An *Sapphirinæ indicatori* pertinet ?

15. Sapphirina bella. — Digitus antennarum posticarum tenuis, fermè carpi longitudine, articulis digiti fere æquis, unguiculo parvulo. Lamellæ caudales divaricatæ, angustæ, lanceolatæ, setis quatuor, duabus apicalibus, aliis externis, totis perbrevibus. — *Maris :* Corpus ovatum, 9-articulatum, segmento ultimo tecto, antico parce oblongo, ad latus totis obtusis. Conspicilla parvula, remotiuscula, inferiora, prope frontem insita. — Splendidè versicolor.

Long. $\frac{1}{15}''$. — *Hab.* in mari Pacifico, prope insulas " Kingsmill."

16. SAPPHIRINA OPALINA. — Digitus antennarum posticarum tenuis, carpo fere longior, unguiculo brevi. Lamellæ caudales suborbiculatæ, apice interno producto, acuto, setis dimidio lamellæ vix longioribus. — *Maris :* Corpus ovatum, 10-articulatum, articulatione primâ fere obsoletâ, segmento postico tecto, quatuor penultimis latere ad angulos posticos acutis. Conspicilla remotiuscula, fronte insita. — Splendidè opalina.

Long. $\frac{1}{8}''$. — *Hab.* in mari Atlantico, lat. bor. 1° - 0°, long. occ. 17° - 18° ; quoque lat. aust. 4° 30′, long. occ. 25°.

17. SAPPHIRINA VERSICOLOR. — Digitus antennarum posticarum tenuis, carpo vix longior, unguiculo longiusculo (dimidium digiti longitudine fere æquante). Lamellæ caudales latæ, latitudine breviores, apice interno producto et acuto, setis quatuor, brevissimis. — *Maris :* Corpus ovatum, 10-articulatum, segmento antico transverso, semicirculari, aliis longitudine subæquis, quatuor penultimis ad latera minutè acutis. Conspicilla remotiuscula, fronte insita. — Opalina. — *S. opalinæ* affinis.

Long. $\frac{1}{10}''$. — *Hab.* in mari Atlantico, prope "Rio de Janeiro," lat. aust. 24°, long. occ. 43°.

18. SAPPHIRINA TENELLA. — Digitus antennarum posticarum tenuis, carpo longior, unguiculo parvulo. Lamellæ caudales latitudine duplo longiores, setis dimidio lamellæ valde breviores, unâ ad apicem internum fere obsoletâ. — *Feminæ :* Cephalothorax ovatus, 5-articulatus, articulatione primâ fere obsoletâ, segmento antico non transverso, posticis inter sese similibus, angulo postico subacuto. Abdomen angustum, 6-articulatum, segmento primo brevissimo, secundo latere obtuso, tribus sequentibus lunatis. Conspicilla remotiuscula, fronte insita. — *Maris :* Corpus longe ovatum, 10-articulatum, posticè segmentis sensim minoribus, segmento antico semicirculari, lateribus obtusis. Conspicilla remotiuscula, fronte insita. — *Maris* corpus diaphanum, pulchrè versicolor ; *feminæ* subdiaphanum, non coloratum.

Long. $\frac{1}{12}''-\frac{1}{15}''$. — *Hab.* in mari Atlantico, lat. aust. 20° - 23°, long. occ. 38° 45′ - 41° ; quoque lat. aust. 4½°, long. occ. 25° ; quoque lat. aust. 24°, long. occ. 43°. — An *S. fulgenti* (M. Edwardsii) pertinet ?

19. SAPPHIRINA OBESA. — Lamellæ caudales latæ, subellipticæ latitudine non duplo longiores, setis brevissimis, fere obsoletis, unâ ad apicem internum vix dispiciendâ. — *Feminæ :* Cephalothorax latè subovatus, convexus 5-articulatus, segmento antico transverso, ultimis duobus duplo brevioribus quam tertio, quarto ad angulos rotundato, quinto ad angulos subacuto. Abdomen 5-articulatum, segmento primo brevissi-

mo, tribus sequentibus lunatis. Conspicilla remotiuscula, fronte insita. — Brunnescens.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, prope insulas "Kingsmill."

20. SAPPHIRINA OBTUSA. — Lamellæ caudales elongatæ, non divaricatæ, setis dimidio lamellæ valde brevioribus. — *Feminæ:* Cephalothorax convexus, 4-articulatus, ad frontem subtruncatus, segmento antico oblongo, lateribus fere parallelis, angulis posticis rotundatis, segmentis aliis dissimilibus, secundo ad latus truncato, tertio rotundato, quarto (vel ultimo) medium ad latus angulato. Abdomen angustum, 5-articulatum, segmento primo parvulo, tribus sequentibus sublunatis. — Rubescens.

Long. $\frac{1}{15}''$. — *Hab.* in mari Pacifico, lat. aust. 43°, long. occ. 78° 45′.

Familia V. MIRACIDÆ.

Oculi duo conspicillis maximis constructi. *Antennæ posticæ* ad apicem setigeræ. *Pedes mandibulares maxillaresque* brevissimi. *Abdomen* feminæ (an *maris* quoque ?) 6-articulatum. *Sacculus ovigerus* unicus.

Genus MIRACIA.

Corpus elongatum, non depressum, ad frontem duas appendices falciformes subtus gerens. *Antennæ anticæ* appendiculatæ, flexiles et non geniculantes. *Pedes antici* (ct. vii.) mediocres, uni-unguiculati ; *pedes* duo sequentes biremes, lateraliter porrecti. *Pedes abdominis* longè setigeri. *Setæ caudales* elongatæ. — *Setellæ* affinis, sed conspicilla oculorum diversæ.

1. MIRACIA EFFERATA. — Corpus 10-articulatum, segmento antico valde latiore, aliis sensim attenuatis. Conspicilla fronte insita, maxima, valde prominentia, contigua. Antennæ anticæ mediocres, 7-articulatæ, articulis tertio quinto septimoque brevibus. Styli caudales oblongi, setis duplo longioribus. — Cyanea.

Long. $\frac{1}{16}''$. — *Hab.* in mari Atlantico, lat. bor. 4° - 7°, long. occ. 20° - 21° 30′ ; quoque lat. aust. 4° 30′, long. occ. 25°.

2. MIRACIA GRACILIS. — Corpus gracile, sensim posticè attenuatum, 10-articulatum, segmento antico non latiore. Conspicilla maxima, paulo prominentia, fronte insita. Antennæ anticæ tenuissimæ, articulis secundo, quarto, duobusque ultimis brevibus. Styli caudales oblongi, setis quadruplo longioribus, fère corporis longitudine. — Cyanea et viridis.

Long. $\frac{1}{16}''$. — *Hab.* in mari Pacifico, lat. aust. 32° 24′, long. orient. 177° ; quoque prope insulam "Sunday."

Tribus 2. DAPHNIACEA (vel Cladocera).

Corpus testâ plerumque tectum, capite antennisque posticis sæpius exclusis. *Pedes* plures natatorii. *Antennæ anticæ* sæpe obsoletæ, raro elongatæ. *Oculus* compositus. [Membra tota cephalothoracis mandibularia, maxillaria, pediformiaque 12 – 16.]

Tribûs hujus familiæ sunt: —

1. Penilidæ. — Pedes duodecim. Antennæ anticæ obsolescentes.

2. Daphnidæ. — Pedes decem. Antennæ anticæ sive obsoletæ sive uni-articulatæ.

3. Bosminidæ. — Pedes decem. Antennæ anticæ elongatæ, multi-articulatæ.

4. Polyphemidæ. — Pedes octo. Antennæ anticæ obsolescentes.

Familia I. PENILIDÆ.

Genus PENILIA. (*D.*)

Caput discretum, longe rostratum. *Antennæ posticæ* grandes, ramis duobus 2-articulatis. *Abdomen* non inflexum, stylis duobus corneis confectum.

1. Penilia avirostris. — Testa dorso valde tumida, posticè latè bicuspidata et ad medium profondè excavata, marginibus infero posticoque per denticulos eleganter armata. Setæ appendicium abdominis dorsalium stylis caudalibus breviores.

Long. $\frac{1}{20}''$. — *Hab.* in porto "Rio Janeiro." — Lect. die 24 Dec., 1838.

2. Penilia orientalis. — Testa dorso tumida, posticè latè bicuspidata, ad medium paulo excavata, marginibus infero posticoque per denticulos eleganter armata. Setæ appendicium abdominis dorsalium stylis caudalibus fere duplo longiores.

Long. $\frac{1}{16}''$. — *Hab.* prope fretum "Sunda." — Lect. die 5 Mar., 1842.

Familia II. DAPHNIDÆ.

Genus I. DAPHNIA.

Abdomen inflexum. *Antennæ anticæ* obsolescentes. *Antennæ posticæ* birameæ, ramis 3 – 4-articulatis. *Intestina* non convoluta.

1. Daphnia textilis. — Valde tumida, subglobosa, paulo oblonga,

post medium paulo latior, posticè breviter subtriangulata, obtusa. Caput breve, brevissimè acutèque rostratum, *supernè visum* breviter subtriangulatum, obtusum. Rami antennarum valde inæqui, tri-articulati. Testa reticulata areolis bene hexagonis.

Hab. in stagnis prope portum "Sandal wood" ad insulam "Vanua Lebu" in archipelago "Viti."

2. DAPHNIA AUSTRALIENSIS. — Valde tumida, paulo oblonga, capite per constrictionem vix discreto; post medium altior, posticè subtriangulata, obtusa, dorso postico subtilissimè denticulato. Caput breve, *supernè visum* triangulatum, obtusum. Rami antennarum posticarum subæqui, setis longiusculis. Testa reticulata, areolis longè angustissimèque linearibus, obliquis, prope marginem valde latioribus.

Hab. in stagnis prope urbem "Sydney" Novi-Hollandiæ.

3. DAPHNIA MACRURA. — Gracilis, elongata, testâ posticè aculeato-productâ, aculeo tenui, paulo breviore quam corpus. Caput grande, corpore non humilius, supra non discretum infra nec rostratum; fronte *latere visâ* rotundatâ, *supernè visâ* bene acutâ. Corpus ad margines dorsales infero-posticosque et aculeus subtilissimè denticulati.

Hab. in stagnis prope urbem "Sydney" Novi-Hollandiæ.

Genus II. SIDA.

Abdomen rectum. *Antennæ anticæ* fere obsoletæ. *Antennæ posticæ* birameæ, ramo uno 2-articulato. *Intestina* non convoluta.

SIDA ANGUSTA. — Angusto-oblonga, posticè parce altior et rotundato-truncata, capite valde discreto, fere oblongo, paulo humiliore quam corpus, fronte obtusâ. Abdomen testâ fere omnino tectum. Antennæ anticæ fere corporis longitudine, ramis basi brevioribus, 2 et 3-articulatis, uno ramo setis paucis ciliato.

Hab. in stagnis ad insulam "Vanua Lebu."

Genus III. LYNCEUS.

Abdomen inflexum. *Intestina* convoluta. *Antennæ anticæ* fere obsoletæ. *Antennæ posticæ* parvæ.

LYNCEUS LATIFRONS. — Valde tumidus; *latere visus* rotundatus, capite indiscreto, brevissimo, rostrato, rostro gracili, acuto, ad corpus strictè appresso; *supernè visus*, fronte latissimè truncatâ parce angustiore quam corpus, latere postico breviter triangulato et obtuso.

Hab. in stagnis ad insulam "Vanua Lebu."

Familia IV. POLYPHEMIDÆ.

Pedes octo. Oculus maximus.

Genus POLYPHEMUS.

Caput discretum, magnum. *Antennæ* birameæ, validæ.

POLYPHEMUS BREVICAUDIS. — Testa posticè tumida rotundata. Caput oblongum (paulo brevius quam testa reliqua), conoideum, anticè latius et globulare. Rami antennarum subæqui 3-articulati, parce setigeri. Pedes crassi. Abdomen non inflexum, breve, crassum, parce exsertum, furcatum, ad apicem acutum.

Long. $\frac{1}{30}''$. — *Hab.* in mari Atlantico, lat. aust. 41°, long. occ. 62°. — Lect. die 25 Jan., 1839.

Tribus 3. CYPRIDACEA (vel Ostracoda).

Corpus testâ bivalvi omnino tectum, posticè incurvatum, capite antennisque nunquam exclusis. *Pedes* nulli biremes nec natatorii. *Oculi* vel simplices vel compositi. *Antennæ* quatuor. [Membra cephalothoracis mandibularia, maxillaria, pediformiaque numero decem.]

Genus I. CYPRIS. (*Müller.*)

Testa integra, ad frontem nec perforata nec incisa. *Oculus* unicus. *Antennæ anticæ* setigeræ, subnatatoriæ. *Antennæ posticæ* subpediformes, setigeræ. *Pedes mandibulares* 3 – 5-articulati. *Maxillæ* quatuor, breves. *Pedes* quatuor, duo uncinis longi confecti, duo sequentes graciles, 4 – 5-articulati, ad ova pertinentes.

1. CYPRIS SPECIOSA. — Oblonga, subovata, anticè angustior, subtus fere recta, vix excavata, alioque bene arcuata, altitudine latior et plus duplo longior; ad marginem anticum pubescens, posticum breviter ciliata. Flava et lætè viridis, areis flavis paucis imperfectis viridi circumdatis.

Hab. in stagnis prope urbem "Rio de Janeiro." — Lect. Dec., 1838.

2. CYPRIS ALBIDA. — *Latere visa*, breviter subelliptica, extremitates fere æqua, latè rotundata, subtus recta, supra obsoletè gibbosa; triplo longior quam latitudo, non duplo longior quam altitudo, margine pubescente. Oculus margine superno remotus. Albido-margaritacea, posticè et supernè paulo brunnea.

Long. $\frac{1}{24}''$. — *Hab.* in stagnis prope "Valparaiso."

3. CYPRIS CHILENSIS. — *Latere visa*, subovata, post medium parce altior, subtus paululo arcuata, dorsum vix gibbosa, triplo longior quam latitudo, duplo longior quam altitudo, marginibus antico infero posticoque pubescentibus. Antennæ anticæ 7-articulatæ, setis dimidio corporis vix longioribus.

Long. $\frac{1}{16}''$. — *Hab.* in stagnis prope "Valparaiso."

4. CYPRIS PUBESCENS. — Brevis; *latere visa*, latissimè fabiformis, subtus recta, extremitatibus latè et æque rotundatis, dorso bene arcuato; *supernè visa*, latè ovata, fronte subacuta; ad totam superficiem pubescens. Antennæ anticæ 7-articulatæ, setis vix longioribus quam 5 articuli ultimi simul sumti. Antennæ posticæ crassiusculæ, articulo ultimo fere dimidii penultimi longitudine, setam longam ad apicem gerente, penultimo ad apicem longè setigero. — Pallidè olivacea.

Hab. in stagnis prope urbem "Sydney" Novi-Hollandiæ.

5. CYPRIS VITIENSIS. — Longè subfabiformis; *latere visa*, altitudine plus duplo longior, subtus recta, dorsum arcuata, ante medium paulo altior, extremitate anticâ latius rotundatâ; *supernè visa*, subelliptica, ante medium vix latior, anticè subacuta, posticè rotundata, latitudine duplo longior; ad totam superficiem pubescens. Antennæ anticæ 7-articulatæ, articulis quinque ultimis inter sese longitudine fere æquis, setis antennâ brevioribus.

Long. $\frac{1}{40}''$. — *Hab.* in stagnis prope portum "Nailoa," ad insulam "Vanua Lebu," in archipelago "Viti."

Genus II. CYPRIDINA. (*Milne Edwards.*)

Testa breviter rostrata corpus omnino tegens, et clausa. *Oculi* duo compositi, remoti. *Antennæ anticæ* setis paucis inæquis ad apicem instructæ, setis rectis, sæpe divaricantibus, vix natatoriis. *Antennæ posticæ* 5 – 7 articulis brevissimis longè et plumosè setigeris confectæ. *Pedes mandibulares* 5-articulati, digitiformes, apicem unguiculati. *Maxillæ* sex, breves, breviter setigeræ, paris secundi laminam ciliatam ad basin gerentes, setis longis, plumosis. *Pedes* duo, longissimè vermiformes, omnino flexiles, ad ova pertinentes, ad apicem setis spinulosis partim reversis armati. *Abdomen* spinulis biseriatis confectum.

1. CYPRIDINA LUTEOLA. — Compresso-ovoidea; *latere visa*, latè elliptica, anticè breviter rostrata, fronte non prominulâ, marginibus aliis arcuatis, posticè non gibboso; *supernè visa*, angusto-ovata, anticè acuta,

posticè rotundata. Digitus pedis mandibularis ad basin crassus, sensim attenuatus. Antennæ anticæ ad apicem 4 – 5-setigeræ, setis antennâ non longioribus. — Luteola.

Long. $\frac{1}{12}''$. — *Hab.* in mari " Sulu."

2. Cypridina punctata. — Compresso-ovoidea, punctata ; *latere visa*, latè ovalis, posticè gibbosa, infra supraque æquè arcuata, anticè breviter rostrata, fronte prominulâ, rostro gracili, acuminato ; *supernè visa*, angusto-elliptica, extremitatibus rotundatis. Spinulæ caudales decem.

Hab. in mari " Sulu."

3. Cypridina olivacea. — Subovoidea ; *latere visa*, oblongo-subelliptica, dorsum parcè arcuata, posticè truncata et sparsim ciliata, anticè rostrata, rostro ad apicem rectangulato, fronte prominente ; *supernè visa*, longè ovata, anticè obtusa, posticè subtruncata. Antennæ anticæ setis corpore longioribus ad apicem instructæ. Spinulæ caudales octo. — Olivacea.

Long. $\frac{1}{10}''$. — *Hab.* in mari " Sulu."

4. Cypridina gibbosa. — *Latere visa*, angusto-subovata, infra supraque arcuata, posticè valde gibbosa, anticè breviter rostrata, rostro acuto, fronte prominulâ. Antennæ anticæ tribus setis longis aliisque brevioribus ad apicem instructæ, setis antennâ paulo brevioribus. Spinulæ caudales sexdecim. — Fere incolorata. Phosphorescens.

Long. $\frac{1}{20}''$. — *Hab.* in mari Pacifico, lat. aust. 15° 20′, long. occ. 148°. — Lect. die 10 Sept., 1839.

5. Cypridina formosa. — Compresso-ovoidea ; *latere visa*, breviter elliptica, infra supraque valde arcuata, margine postico interrupto, non gibboso ; *supernè visa*, angusto-elliptica, extremitatibus obtusis. Antennæ anticæ longè setigeræ, setis antennâ parce longioribus. Pedes mandibulares digitum tenues. Spinulæ caudales decem. — Pallidè purpurea et maculis lætè purpureis notata.

Long. $\frac{1}{10}''$. — *Hab.* in mari Pacifico, prope insulam " Upolu." — Lect. die 26 Feb., 1841.

Genus III. CONCHÆCIA. (*Dana.*)

Testa interdum breviter rostrata, corpus omnino tegens, fronte apertâ. *Oculi* simplices. *Antennæ anticæ* 3 – 4-articulatæ, apicem longè setigeræ. *Spiculum* inter antennas sarcosum, simplex, exsertile. *Antennæ posticæ* 5 – 7-articulatæ, articulis brevissimis longè setigeris confectæ, ramo altero brevi. *Pedes mandibulares* fermè 5-articulati,

non unguiculati, apice interno articuli primi sæpius etiam basi interno secundi simul corneis (instar mandibulæ) et denticulatis. *Maxillæ* quatuor. *Pedes* quatuor, tenues. *Abdomen* spinulis biseriatis confectum.

1. CONCHÆCIA AGILIS. — *Supernè visa*, longè ovata, anticè rotundata, posticè acuta; *latere visa*, oblonga, subrectangulata, anticè paulo altior, frontem instar rostri paulo producta, posticè rectè truncata angulo superno acutè rectangulato. Spiculum sagitto-capitatum. Antennæ anticæ 3-articulatæ, setis rectis ad apicem curvatis, unâ crassiore et prope apicem subtilissimè denticulatâ. Pedes mandibulares 5-articulati, articulo secundo valde oblongo, recto, sequentibus sensim attenuatis. — Viridescens.

Long. $\frac{1}{20}''$. — *Hab.* in mari Atlantico, lat. bor. 0° - 4°, long. occ. 17° 30′ - 20° 10′; lat. aust. 0° - 6°, long. occ. 17° 30′ - 24°. — Lect. diebus 25, 26, 27, 29 Oct., et 2, 3, 5, 8 Nov., 1838.

2. CONCHÆCIA ROSTRATA. — *C. agili* similis. — Pedes mandibulares sensim non attenuati, articulis duobus apicalibus feré æquis, vix oblongis, setis longis. Pedes penultimi ultimis duplo longiores longèque setigeri.

Hab. in mari Pacifico, prope insulas "Kingsmill."

3. CONCHÆCIA BREVIROSTRIS. — *Supernè visa*, brevissimè elliptica, extremitatibus subacutis; *latere visa* literæ ⌣ formam similis, dorsam fere recta, posticè rotundata, fronte prominulâ, et truncatâ. Antennæ anticæ setis inæquis, setâ longiore curvatâ prope apicem incrassatâ, nudâ. Spiculum capite cylindrico. Antennæ posticæ 7-articulatæ, articulo secundo non duplo longiore quam sequentes simul sumti. — Albida. Testa lineis parallelis subtilissimè notata.

Long. $\frac{1}{16}''$. — *Hab.* in mari Atlantico, lat. aust. 23°, long. occ. 41° 10′. — Lect. die 19 Nov., 1838.

4. CONCHÆCIA INFLATA. — *Supernè visa*, brevissimè ovata, frontem rotundata, posticè subacuta; *latere visa* subrotundata, dorsum fere recta, literæ ⌣ formam similis, angulis rotundatis, fronte obsoletè prominulâ. Spiculum cylindricum. Antennæ anticæ 3-articulatæ, setis longis, unâ subclavatâ, nudâ. Antennæ posticæ 7-articulatæ, articulo secundo plus duplo longiore quam 5 ultimi simul sumti. Pedes mandibulares 5-articulati, articulo secundo brevi, non longiore quam tertius, basi longè et crassè producto, primo ad apicem pariter producto, his processubus duobus corneis denticulatis instar mandibulæ.

Long. $\frac{1}{15}''$. — *Hab.* in mari Atlantico, lat. aust. 1°, long. occ. 18°; et lat. aust. 11°, long. occ. 12°. — Lect. die 5 Nov., 1838, et die 6 Maii, 1842.

Subordo 2. CORMOSTOMATA.

Os rostriformis. — Tribus quatuor sequentes: —

I. Monstrillacea. — Corpus elongatum (Cyclopi simile). Maxillæ pedesque antici obsoleti. Pedes postici octo natatorii.

II. Caligacea. — Corpus sæpius depressum. Maxillæ pedesque toti numero 12 – 14, octo pedes ultimi plerumque natatorii, plurimi testâ tecti.

III. Lernæacea. — Corpus depressum aut vermiforme. Antennæ pedesque partim obsoleti.

IV. Nymphacea. — Corpus breve, araneiforme, abdomine obsolescente.

Tribus I. MONSTRILLACEA.

Genus MONSTRILLA. (*Dana.*)

Cephalothorax fere cylindricus, 4-articulatus. *Abdomen* 5 – 6-articulatum. *Antennæ* duæ. *Oculi* duo simplices; quoque oculus inferior sicut *Pontellis*. *Truncus buccalis* parvulus subconicus, maxillis pedibusve non munitus. *Pedes* octo, natatorii.

Monstrilla viridis. — Gracilis, posticè attenuata. Oculi remoti. Antennæ 5-articulatæ, setis antennâ brevioribus. Abdomen 5-articulatum, segmento secundo breviore quam primus vel secundus. Styli caudales oblongi, parvi, divaricati, setis 5 subæquis, diffusis. — Lætè graminea.

Long. $\frac{1}{5}''$. — *Hab.* in mari "Sulu." — Lect. die 3 Feb., 1842.

Tribus 2. CALIGACEA.

Familiæ quinque sequentes: —

1. Argulidæ. — Corpus anticè latè peltatum. Ovarium externum nullum. Pedes antici largè tubulati, suctatorii.

2. Caligidæ. — Corpus anticè latè peltatum. Ovarium externum tubiforme, rectum, ovis uniseriatis. Pedes quatuor antici subprehensiles. Antennæ posticæ carapace tectæ.

3. DICHELESTIDÆ. — Corpus depressum, valde angustum. Antennæ posticæ carapace non tectæ. Ovarium externum tubiforme, ovis uniseriatis.

4. ERGASILIDÆ. — *Corycæis* affines. Corpus vix depressum, plus minusve Cyclopiforme. Antennæ posticæ carapace non tectæ. Ovarium externum elongatum aut sacculiforme, ovis non uniseriatis.

5. NICOTHOIDÆ. — Corpus plerumque Cyclopiforme, sed e lateribus longissimè alatum. Ovarium externum sacculiforme, ovis non uniseriatis.

Familia II. CALIGIDÆ.

Subfamiliæ Caligidarum nobis sunt: —

1. CALIGINÆ. — Truncus buccalis subovatus, obtusus. *Maxillæ* trunco remotiusculæ, posticè aculeo-elongatæ. *Tubum* ovigerum externum rectum. Corpus anticè latius. (Genera sunt *Caligus*, *Lepeophtheirus*, *Chalimus*, *Caligeria*, *Calistes*.)

2. PANDARINÆ. — Truncus buccalis tenuis acuminatus. Maxillæ ad truncum appressæ, parvulæ, lamellatæ. Tubum ovigerum externum rectum. Corpus posticè interdum latius. (Genera sunt *Pandarus*, *Trebius*, *Nogagus*, *Specilligus*, *Dinematura*, *Phyllophora*, *Euryphora*, *Lepidopus*.)

3. CECROPINÆ. — Truncus buccalis tenuis, acuminatus. Maxillæ ad truncum appressæ. Tubum ovigerum externum sub testam convolutum. Corpus posticè latius. (Genera sunt *Cecrops*, *Læmargus*.)

Caligaceorum segmenta corporis auctoribus sæpe malè data. Segmentum abdominis anticum, ovarium externum gestans, thoracis posticum sæpe vocatum.* In Cyclopaceis Caligaceisque ovarium externum ad segmentum secundum abdominis normalem semper pertinet. Si hæc animalia Cyclopaceis Crustaceisque aliis comparentur, affinitates veras educemus. Tabula sequens, membris ordine enumeratis, hæc comparationem exhibet.

* Vide *Hist. Nat. des Crustaces*, par M. Milne Edwards, III. 445 et seq.

SEGMENTA.*	ASTACUS.	LUCIFER.	CYCLOPS.	PONTELLA.	CALIGUS.	PENILIA.	DAPHNIA.	CYPRIS.
1. *Cephalothoracis.*								
I.	Oculi	Oculi	00	00	00	00	00	00
II.	Ant. I.	Ant. I.	Ant. I.	Ant. I.	Ant. I.	Ant. I.	00	Ant. I.
III.	Ant. II.	Ant. II.	Ant. II.	Ant. II.	Ant. II.	Ant. II.	Ant. II.	Ant. II.
IV.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.	Mand.
V.	Max.	Max.	Max.	Max.	Max.	Max.	Max.	Max.
VI.	Max.	Max.	Maxd.	Maxd.	P. verg.	P. nat.	P. nat.	Maxd.
VII.	Maxd.	Maxd.	P. preh.	P. preh.	P. preh.	P. nat.	P. nat.	P. verg.
VIII.	Maxd.	Maxd.	P. nat.	P. nat.	P. nat.	P. nat.	P. nat.	P. ovar.
IX.	Maxd.	P. subnat.	P. nat.	P. nat.	P. nat.	P. nat.	P. nat.	00
X.	P. chel.	P. subnat.	P. nat.	P. nat.	P. nat.	P. nat.	P. nat.	00
XI.	P. verg.	P. subnat.	P. nat.	P. nat.	P. nat.	P. nat.	00	00
XII.	P. verg.	P. subnat.	0 vel 00	P. genit.	00	00	00	00
XIII.	P. verg.	0	00	00	00	00	00	00
XIV.	P. verg.	0	00	00	00	00	00	00
2. *Abdominis.*								
I.	P. rud.	P. rud.	0 vel P. rud.	0 vel 00	0 vel 00	P. rud.	0 vel P. rud.	0 vel 00
II.	P. rud.	P. rud.	0	0	0	0	0	0
III.	P. rud.	P. rud.	0	0	0	0	0	0
IV.	P. rud.	P. rud.	0	0	0	0	0	0
V.	P. rud.	P. rud.	0	0	0	0	0	0
VI.	App. caud.	App. caud.	App. caud.	App. caud.	App. caud.	App. caud.	App. caud.	App. caud.
VII.	0	0	00	00	00	00	00	00

* Hæc tabula abbreviationes sequentes continet: —

Ant.	Antennæ.	*P.*	Pedes.	*Preh.*	Prehensiles.
Mand.	Mandibulæ.	*Chel.*	Cheliformes.	*Ovar.*	Ovariani *vel* ovarium.
Max.	Maxillæ.	*Verg.*	Vergiformes.	*Rud.*	Rudimentarii.
Maxd.	Maxillipedes.	*Nat.*	Natatorii.	*Caud.*	Caudales.

Segmenti membra obsoleta, 0 significat; segmentum membraque ambo simul obsoleta, 00.

Subfamilia 1. CALIGINÆ.

Genus I. CALIGUS.

Cephalothorax 2-articulatus; segmento antico latè peltato, fronte discis duobus suctatoriis plerumque instructâ; postico parvulo, non alato. *Oculi* simplices pigmento unico conjuncti. *Antennæ posticæ* prehensiles, et extus basin sæpius spinâ crassâ munitæ. *Pedes* duo antici

vergiformes, bifidi; * duo proximi sequentes subprehensiles digito acuto confecti ; sex sequentes natatorii ; duo reliqui simplices, vergiformes. Venter furculâ parvulâ armatus. *Abdomen* 2 – 3-articulatum, appendicibus caudalibus sublamellatis, marginem setigeris. [Sexus, antennas posticas, pedes paris secundi, et formam abdominis, valde dissimiles.]

1. Caligus Thymni. — Carapax oblongus, discis suctatoriis subfrontem munitus. Abdomen 3-articulatum, segmento primo ad basin lato, sequentibus duplo latiore ; ano valde prominente. Styli caudales parvuli, ad angulos abdominis posticos insiti, anum vix superantes. Antennæ posticæ spinâ extus basin non munitæ. Furcula simplex, brachiis divergentibus, subacutis. — *Feminæ :* Abdominis segmentum primum oblongum, lateribus rectis et posticè parce divergentibus, angulis posticis prominentibus ; segmentis duobus sequentibus simul sumtis elongatis, et fere longioribus. — *Maris :* Abdominis segmentum primum subquadratum, angulis posticis vix prominentibus, segmentis sequentibus simul sumtis brevioribus.

Long. $\frac{3}{8}''$. — *Hab.* in corpus *Thymni pelamys* mari Atlantico, lat. bor. 27°, long. occ. 19° 30′. — Lect. die 27 Sept., 1838.

2. Caligus productus. — *Feminæ :* Carapax ovatus, discis suctatoriis subfrontem munitus. Segmentum secundum angustum. Abdomen 3-articulatum, segmento primo ad basin perangusto; ano non prominulo. Styli caudales parce oblongi, terminales. Antennæ posticæ ad basin posticè acûtæ et extus basin spinâ munitæ. Furcula simplex, brachiis parce divergentibus, tenuibus, acutis. — Segmentum abdominis anticum oblongum, subellipticum, angulis posticis longè crassèque productis, sequentibus angustis, fere lineatis.

Long. $\frac{1}{4}''$. — *Hab.* intus operculum *Thymni pelamys*, in mari Atlantico, lat. bor. 27°, long. occ. 19° 30′. — Lect die 27 Sept., 1838.

3. Caligus gracilis. — *Feminæ :* Carapax oblongus, fere ellipticus, discis suctatoriis rotundatis. Segmentum secundum transversum, brevissimum. Abdomen 2-articulatum, segmento antico fere quadrato, postico angustiore, parce oblongo, posticè truncato. Styli caudales terminales, paulo oblongi. Furcula ventralis simplex, brachiis divergentibus, truncatis. Antennæ posticæ spinâ oblongâ extus basin munitæ.

Long. $\frac{1}{6}''$. — *Hab.* in corpus Serrani, in mari juxta " Rio de Janeiro."

* Extremitas bifida articulo tertio et apice secundi elongato composita.

4. Caligus (Lepeophtheirus) Bagri. — Carapax subrotundatus, discis suctatoriis non munitus : segmentum secundum fere oblongum. Abdomen 3-articulatum, segmento primo valde latiore ; segmentis duobus posticis simul sumtis oblongis, ano prominente. Styli caudales parvuli ad angulos abdominis posticos insiti, anum vix superantes. Antennæ posticæ spinâ extus basin non munitæ. Furcula simplex, brachiis divergentibus, subacutis. — *Feminæ :* Abdominis segmentum primum valde oblongum, posticè truncatum, anticè angustius, lateribus parallelis. — *Maris :* Segmentum abdominis primum latum, paulo oblongum, subhexagonum. Pedes paris secundi crassissimi, digito acuto setâque internâ armato, margine manûs interno fere recto, pollice nullo.

Long. $\frac{1}{4}''$. — *Hab.* in corpus et intus opercula Bagri, juxta " Rio de Janeiro." — Lect. Nov., 1838.

Genus II. CALISTES. (*Dana.*)

Caligo similis. *Cephalothorax* 2-articulatus, segmento postico non alato. *Pedes duo postici* biramei, subnatatorii.

Trebio affinis, ced cephalothorax non 3-articulatus et maxillæ nec lamellares, nec ad truncum buccalem appressæ.

Calistes Trigonis. — *Feminæ :* Cephalothorax subrotundatus, discis suctatoriis nullis. Segmentum secundum parvum, lateribus rotundatis. Abdomen 3-articulatum, segmento primo lato, sequentibus lineatis, ano vix prominente. Styli caudales styliformes, oblongi. Antennæ posticæ spinâ corneâ longâ extus basin munitæ. Furcula simplex, brachiis parallelis. Maxillæ posticè aculeo-furcatæ. Pedes postici natatorii, ramis 3-articulatis, parce subæquis, setis longis. — Segmentum abdominis primum subquadratum, angulis rotundatis, duobus sequentibus fere æquis et simul sumtis non brevioribus quam primum, lineatis.

Long. $\frac{1}{4}''$. — *Hab.* in corpus speciei Trigonis. — Lect. juxta " Rio de Janeiro," Dec., 1838.

Genus III. CALIGERIA. (*Dana.*)

Caligo similis. *Cephalothorax* 2-articulatus, segmento postico bialato. *Pedes duo postici* biramei, setis brevibus, non natatoriis.

Caligeria bella. — *Feminæ :* Cephalothorax rotundatus, discis suctatoriis nullis. Segmentum secundum transversum, angulos posticos alatum, alis latis, approximatis, margine toto arcuato. Abdomen 3-

articulatum, segmento primo lato, tertio posticè truncato, lamellis caudalibus latis, paulo oblongis, contiguis, setis lamellâ brevioribus, fere æquis. Furcula simplex, tenuis, basi angustissimo, brachiis divergentibus. Pedes postici tenues, ramis valde inæquis, ramo breviore 2-articulato, altero 3-articulato. — Segmentum abdominis primum paulo oblongum, subellipticum, angulis posticis rotundatis, segmentis sequentibus dimidio angustioribus, non oblongis, subæquis.

Hab. in branchias speciei Thynni, in mari Atlantico, lat. aust. 11°, long. occ. 14°. — Lect. die 7 Maii, 1842.

Subfamilia 2. PANDARINÆ.

Genus I. NOGAGUS. (*Leach.*)

Cephalothorax 4-articulatus, fronte arcuatâ, segmento secundo ad latera posticè producto, duobus sequentibus non alatis. *Abdomen* stylis brevibus sublamellatis setigerisque confectum. *Oculi* simplices, remotiusculi; (an quoque oculus subtilissimus intermedius ?). *Pedes* paris secundi crassè cheliformes; pedes natatorii octo, grandes.

NOGAGUS VALIDUS. — *Feminæ?* Carapax paulo oblongus, ellipticus, segmento secundo ad latera posticè producto, segmentis duobus sequentibus transversis. Pedes secundi paris crassissimè cheliformes, pollice brevi, truncato, digito obtuso. Abdomen 2-articulatum, segmento antico subquadrato, angulis posticis prominulis; segmento postico brevi, transverso, angulis posticis truncatis. Styli caudales latè lamellati, paulo oblongo, setis tribus plumosis.

Hab. in corpus Squali, mari Pacifico prope Novi-Zealandiam. — Lect. die 15 Ap., 1840.

Genus II. SPECILLIGUS. (*Dana.*)

Nogago segmenta cephalothoracis pedesque affinis. *Oculi* duo remotiusculi, et *conspicillis grandibus instructi*, eisque Sapphirinæ similes.

SPECILLIGUS CURTICAUDUS. — *Feminæ?* Carapax oblongo-ellipticus, anticè arcuatus, discis suctatoriis post antennam anticam munitus. Segmentum secundum ad latera posticè productum, tertium quarto latius et dimidio carapacis parce latius. Pedes secundi paris crassissimè cheliformes, pollice brevi truncato, digito obtuso. Abdomen 2-articu-

latum, segmento antico paulo oblongo, angulis posticis truncatis et setam minutam gerentibus, segmento postico brevi, ano prominente ; stylis parvulis, triangulatis, ad angulos insitis, anum non superantibus, setis tribus, plumosis.

Hab. in corpus Squali, mari Pacifico prope Novi-Zealandiam. — Lect. die 15 Ap., 1840.

Genus III. PANDARUS. (*Leach.*)

Cephalothorax 4-articulatus, carapace grandi, segmentis sequentibus transversis, secundo ad latera alatè producto, tertio quartoque posticè alatis, et bilobatis. *Abdomen* 2–3-articulatum, segmento ultimo tecto, secundo posticè rotundato et utrinque stylis caudalibus sæpius munito. *Pedes* paris secundi crassè cheliformes ; natatorii octo, setis brevissimis. *Oculi* duo, remotiusculi. *Styli caudales* styliformes, acuti, subnudi.

1. Pandarus concinnus. — Carapax paulo oblongus, ellipticus, posticè truncatus et dentatus, angulis posticis paululo elongatis, obtusis. Segmentum secundum brevissimum, alis divaricatis, subrectangulatis, angulis posticis subacutis. Segmenta duo sequentia transversa, subæqua, lobis rotundatis acutè sejunctis. Abdomen 3-articulatum, segmento antico lato, posticè profundè excavato, lateribus arcuatis, angulis posticis acutis, bene divaricatis. Styli caudales non tecti.

Hab. in corpus Squali, mari Pacifico juxta insulam "Tongatabu."

2. Pandarus Satyrus. — Carapax vix oblongus, posticè sensim latior, angulis posticis parce prominentibus, margine postico integro, antico obsoletè denticulato. Segmentum secundum brevissimum, alis divaricatis, oblongo-ellipticis. Segmenta cephalothoracis sequentia transversa, primo minore, lobis rotundatis acutè sejunctis. Abdomen 3-articulatum, articulo antico grandi, posticè angusto-excavato, lateribus fere rectis, parce deinde subito angustioribus et angulis posticis internis acutis ; segmento secundo dimidio vix angustiore, oblongo, obovato. Styli caudales non tecti.

Long. 5′′. — *Hab.* in corpus Squali, mari Pacifico juxta insulam "Tongatabu."

3. Pandarus brevicaudus. — Carapax vix oblongus, subellipticus, posticè valde excavatus, angulis posticis longè productis, obtusis. Segmenta sequentia tria transversa. Alæ segmenti secundi non divaricatæ, posticè obtusæ. Segmenta tertium quartumque abdomine non latiora,

margine dorsali postico latè excavato. Segmentum abdominis anticum subquadratum, angulis posticis obliquè truncatis et setâ minutâ extus instructis, posticè angustum, subtruncatum; segmentum secundum parvulum, transversum stylis triplo longioribus.

Long. $\frac{1}{4}''$. — *Hab.* in corpus Squali, mari Pacifico prope Novi-Zealandiam.

Genus IV. DINEMATURA. (*Latreille.*)

Cephalothorax 3-articulatus, segmento secundo parvo, testâ tertii dorsali posticè valde expansâ et profundè bilobatâ, eoque elytroideâ. *Abdomen* 2-articulatum, carapace paulo angustius, oblongus, segmento antico maximo, posticè bilobato, postico parvulo, celato. *Styli caudales* lamellati, terminales.

Dinematura braccata. — Carapax fere rotundatus, abdomine latior, discis suctatoriis post antennas munitus; posticè quadrilobatus, lobis duobus internis angustis, curvatis, subacutis. Segmentum secundum transversum, ad latus subacutum. Segmenti alæ tertii vix oblongæ, dimidii abdominis longitudine, posticè parce latiores, angulis rotundatis, margine postico fere recto. Segmentum abdominis primum profundè bilobatum, secundum quadratum. Styli caudales grandes, subovati, abdominis extremitatem paulo superantes, setis paucis brevissimis.

Long. $\frac{1}{2}''$. — *Hab.* in corpus Squali, mari Pacifico juxta insulam "Tongatabu."

Genus V. LEPIDOPUS. (*Dana.*)

Corpus anticè non latius. *Cephalothorax* 3-articulatus, carapace minore quam abdomen, segmentis duobus sequentibus posticè largè bialatis. *Abdomen* 2-articulatum, segmento postico parvulo, celato, antico maximo et posticè bilobato. *Antennæ posticæ* articulo tenui falciformi confectæ. *Pedes paris secundi superficie terminali latâ prehensili squamatâ instructi. Pedes natatorii* quatuor ultimi similes, latè lamellati.

Lepidopus armatus. — Corpus oblongum, posticè sensim latius. Carapax subquadratus, posticè paulo latior, margine postico vix arcuato. Segmenta duo sequentia subæqua, alis grandibus, fere rotundatis. Abdomen oblongum, carapace valde longius, posticè non angustius, paulo bilobatum, lobis rotundatis. Antennæ posticæ ad apicem longè falciformes et denticulis biseriatis armatæ, articulo penultimo subquadrato.

Pedes paris secundi grandes, articulo penultimo ad apicem spinigero, ultimo crassissimo, superficie terminali oblongâ, squamatâ, squamulis spinulâ armatis.

Long. $\frac{1}{3}''$. — *Hab.* in corpus speciei Musteli (Squalorum familiæ). — — Lect. ad urbem "Rio de Janeiro."

Tribus 4. NYMPHACEA.

Genus ASTRIDIUM. (*Dana.*)

Pycnogono affinis. *Caput* duobus maxillipedibus subtus instructum parvulis, debilibus, apice obtusis, non prehensilibus. *Pedes* octo unguiculo confecti. *Abdomen* perbrevis.

Astridium orientale. — Cephalothorax stellatus, segmentis medio connatis, deinde liberis. Abdomen breve, posticè angustius, obtusum. Truncus buccalis oblongus, subcylindricus, corpore vix brevior. Segmentum corporis primum anticè non transversum, posticè angustius et deinde utrinque longè productum instar rami brevis,* et pedes anticos gerens. Maxillipedes parvuli, obsoletè 3-articulati, obtusi. Pedes crassiusculi, articulo primo vix oblongo, sequentibus sex subæquis, tertio paulo breviore.

Long. $\frac{1}{8}''$. — *Hab.* in mari "Sulu." — Lect. die 11 Feb., 1842.

Mr. Borden, from the committee to whom was referred the paper of Mr. M. Conant, describing his "Solar Index," presented a report, entering fully into the investigation of the principles of the instrument. The conclusion which the committee has arrived at is, that, although the "Solar Index" is not susceptible of sufficient accuracy to be used with advantage for nice scientific purposes, yet, as it can be managed with great facility, it may frequently be found valuable to the surveyor and engineer in making experimental surveys, running preliminary lines, &c., for the purpose of learning the character of the topography of a country, and of acquiring, approximately at least, a knowledge of the relative situation of places.

* Hæc pars postica segmenti primi segmentum corporis secundum vere est, quamvis articulatione verâ non sejuncta.

Professor Horsford presented the following communication, embodying the results of his investigations and experiments on the chemical action of water of various kinds upon the materials ordinarily employed for its transmission and distribution.

"Materials for the transmission of water, to be used as a beverage in any form, should be strong and durable, should admit of ready repair and replacement, be sufficiently cheap to permit general use, and, above all, should impart no deleterious property to the waters served through them. The safety of using water supplied through wooden aqueducts, and the certainty of their rapid decay, are too well known to require more particular mention. Pipes of iron, tin, of tinned iron, tinned copper, tinned lead, glass, and gutta percha, are of comparatively recent introduction. They are believed, so far as experience has shown, to impart few or no deleterious properties to water as a beverage, though all of them are wanting in some of the essential attributes just mentioned.

"As pipes of lead have been long in use, and possess in an eminent degree most of the properties required for aqueduct service, and as the following researches have been more especially directed to ascertain the true value of leaden pipes for the distribution of water, a brief historical sketch of the opinions that have been entertained with regard to the safety of employing them may not be without interest.

"The period of the first employment of lead for transmitting water is unknown; but the fact that it was condemned by Vitruvius, a Roman architect believed to have lived about nineteen hundred years ago, is evidence of its having at that time been long enough in use to furnish the experience which led to its rejection as a material for aqueducts.* Galen, a physician of Amsterdam, who wrote in the seventeenth century, coincided with Vitruvius. Both had observed the formation of white lead in water-pipes, and attributed to it the illness which was known to affect those who drank certain waters served through leaden pipes. Notwithstanding these strongly expressed opinions and occasional fatal consequences from drinking water containing lead in solu-

* Leaden pipes may be seen at this day among the ruins of the Coliseum, and leading to the baths and fountains of Herculaneum and Pompeii.

Kopp thinks lead as a metal was known to the Israelites. *Geschichte der Chemie.* It is certain that it was known and in use 400 years before the Christian era.

tion, public sentiment continued strongly in favor of this kind of pipes; and until about the commencement of the present century no experimental examination of the subject had been undertaken. Dr. Lamb of England, and later Guyton Morveau of France, devoted their attention for a time to this inquiry. Their opinions illustrate the uncertainty which attends the earlier labors in every field of investigation. The one believed that most, if not all, spring waters possess the property of acting upon lead to such an extent as to render their conveyance through leaden tubes unsafe, and this *because of the salts in solution;* — the other, that many natural waters scarcely act on lead at all, and *because of the salts in solution.* The former believed that rain or snow water (eminently pure) does not corrode lead; the latter, that distilled water, the purest of all waters, acts rapidly on it. Dr. Thompson of Glasgow subsequently gave some consideration to the subject, and came to the conclusion, that, though Dr. Lamb's general proposition was true, the lead was not *dissolved*, but *suspended merely*. Such was the doubt upon this point, — the insolubility of oxide of lead, — that a scientific association in Germany made it a prize problem. The honor of deciding the question was accredited to Brendecke, whose views were coincided in by his unsuccessful competitor, Siebold,* and also by Herberger, who prepared his oxide of lead in a different manner, and reported his results at a later period. They decided that *oxide of lead is insoluble* in water.

"The imperfection of the investigation and the injustice of this award have since been established by the labors of Yorke,† and Bonsdorff,‡ who have found that aerated, distilled water, deprived of carbonic acid, oxidates metallic lead and dissolves the oxide in the proportion of from $\frac{1}{7000}$th to $\frac{1}{12000}$th. Even the acute Scheele had remarked the same fact in the last century. Philips denied the accuracy of the conclusions of both Yorke and Bonsdorff, and maintained, with Thompson, that the oxide of lead was not soluble, but was only in suspension. His view was supported by the fact, that filtration seemed to separate the lead from the water that originally contained it. In 1846 Yorke § reviewed the investigation of Philips, and showed that, in filtration, the oxide of lead enters into combination with the woody fibre of the filter-

* *Phar. Cent. Blatt.*, 1835, p. 831; *Buch. Rep.*, III., pp. 155 - 179.

† *Pogg. Ann.*, XXXIII., pp. 110 - 112.

‡ *Phar. Cent. Blatt.*, 1836, p. 520; *Buch. Rep.*, V., pp. 55 - 59.

§ *Phil. Mag.*, XXVIII., pp. 17 - 20.

ing paper. By filtering for some time through the same paper it became saturated, and the lead in solution passed without detention.

" Christison, to whom we are indebted for a careful record of the principal conflicting opinions upon this subject, repeated and extended the experiments of Guyton Morveau, to ascertain the effect of solutions of certain salts in water. He came to the conclusion that arseniates, phosphates, sulphates, tartrates, and even chlorides, acetates, and nitrates, possess the power of protecting lead from the action of the water. Of the nature of this protecting power he acknowledges that he has no clear conception. He assured himself that it does not in all cases arise from the formation of an insoluble coat consisting of the acid of the employed salt united to the oxide of lead, by finding that the coat, which for the most part, in his experiments, consisted of carbonate of lead, readily dissolved in acetic acid. This author has suggested that leaden pipes, before being laid down for service, should be exposed a length of time to solutions of some of the salts, denominated *protecting ;* having observed that leaden pipes, which poisoned certain waters when first served, after a time became coated, and passed the same waters without injury to the health of those who drank them.

" The city of London has long been supplied with water distributed through lead, and though occasional excitements upon this subject have sprung up in Great Britain from individual cases of poisoning, the prevailing public sentiment is in favor of lead. Professor Graham states that in London lead only is used for service-pipes. The exemption of Paris from illness derived from this cause is asserted by Tanquerel.* This is believed to be true of all the larger European towns whose inhabitants are supplied with water from public reservoirs. On the other hand, the inhabitants of Amsterdam were poisoned by drinking rain-water that had fallen on leaden roofs ; and on replacing the lead with tiles, the maladies ascribed to the former disappeared.

" We find ourselves at the conclusion of the literature of the Old World upon this subject with these impressions : —

" 1st. That some natural waters may be served from leaden pipes without detriment to health. 2d. That others may not ; and 3d. That we have no method of determining beforehand whether a given water may or may not be transmitted safely through lead.

" Professor Silliman, Jr., in his able report on the various waters sub-

* Tanquerel *on Lead Diseases*, edited by Dana, App., p. 396.

mitted to him by the Water Commissioners, in 1845, has given the results of some experiments upon the action of several waters on lead, which conducted him to the general conclusions above expressed.* Among those who have taken strong ground against leaden service-pipes for the transmission of water may be mentioned Drs. Chilton and Lee of New York, and Drs. Dana and Hayes of Lowell.

"The occasion of the following research was the request by the Board of Consulting Physicians of the city of Boston, in January of 1848, that a comparison of the action of Cochituate Lake, Jamaica Pond, and Croton and Schuylkill River waters upon lead should be instituted. Cochituate water was about to be introduced into Boston for the supply of the city. Jamaica water has been employed in certain sections of the city of Boston since the year 1795, and for the last twenty years served through leaden pipes. Croton River water, since 1842, has been supplied through iron mains and leaden service-pipes to the citizens of New York, a city of 400,000 inhabitants. Schuylkill River water, since the year 1815, has been supplied through iron mains and leaden distribution-pipes to the inhabitants of Philadelphia, a city of 300,000 inhabitants. The inquiry that early presented itself to the Board of Consulting Physicians was the following: — *Will there be greater liability to lead-disease from drinking Cochituate water, served through iron mains and leaden pipes, than there is now from drinking Fairmount or Croton waters similarly served, or Jamaica water possibly less favorably served than Cochituate water will be?*

"To answer this question, Croton, Fairmount, Jamaica, and Cochituate waters were provided with care, and the proposition made that lead should be presented to them all under similar circumstances. It was not proposed to introduce the absolute conditions of actual service in a series of laboratory experiments. It was conceived that, when in contact with lead, all the external circumstances being the same, the differences in the action upon lead would be a kind of exponent of the differences in constitution among the waters. A sufficiently extended series of experiments, it was believed, would reveal all the expedients to be resorted to in order to the fulfilment of the required conditions, and would, if duly extended, furnish replies to the various inquiries into which the main problem of the measure of safety or danger resolved itself.

* *Boston Water-Com. Report,* App., 1845.

" Should the experiments result in showing that the several waters were alike in their action upon lead, then would the citizens of Boston, in drinking Cochituate water served from leaden pipes and iron mains, be as little liable to lead-disease as are the citizens of Philadelphia and New York who drink Schuylkill and Croton water similarly served, and that portion of the citizens of Boston who have for nearly a quarter of a century employed Jamaica water served through lead. Should Cochituate water be found to act less on lead than Jamaica water, all external circumstances being the same, then would the question be affirmatively and more satisfactorily decided; since these two waters occur in the same geological associations, are about equally pure, and the latter has been drunk under less favorable circumstances than Cochituate will be, so far as the relations to lead are concerned. On the other hand, should the inequality in action of the waters be great, and that of the Cochituate uniformly most energetic, then would the question, so far as this mode of investigation could influence it, be decided in the negative.

" The experimental result being favorable, the question of probable future illness to arise from drinking Cochituate water would be decided by an appeal to those physicians of New York, Philadelphia, and Boston, whose extensive practice and standing in the profession demand confidence in their opinions; and by an appeal to public sentiment, where every day's experience among all classes, the less and the more careful, contributes to its formation.

" Such experiments have been made with all the waters above mentioned, and at the same time, in many cases, parallel suites with Albany and Troy reservoir waters, Cambridge well-water, and distilled water, contemplating all the conditions that could be expected to occur. They were conducted in an apartment where, with rare exceptions, no other laboratory labor was carried forward than that connected with this investigation, and in which the tests with hydrosulphuric acid were not made. Whatever influences from temperature or other causes operated upon any one of the waters operated equally upon each of the others. With the exception of Cochituate water, which possessed a yellowish-brown tint, the samples were colorless. A determination of their general relations to each other was made.*

* Professor Silliman, Jr. has made a similar determination of the relations of the Croton, Cochituate, and Fairmount waters. *Water-Com. Report*, 1845.

"*Albany Reservoir Water.* — 500 cubic centimetres evaporated to dryness in a platinum capsule over a water-bath gave, of solid residue, 0.0924gr. Ignited, the above residue lost 0.0198gr.

"*Cambridge Well-water*, that does not act on lead so as to produce known deleterious effects. — 500cc. evaporated to dryness over a water-bath gave, of solid residue, 0.3918gr.; of which 0.0990gr. were expelled by ignition, and of the non-volatile matters 0.0676gr. were insoluble in boiling water.

"*Cambridge Well-water*, that, in an inch-and-a-quarter pipe several years in use dissolves a grain and a half of lead in thirty-six hours. — 500cc. evaporated to dryness over a water-bath gave, of solid residue, 0.1380gr.; of which 0.0540gr. were expelled by ignition.

"*Cochituate Lake Water.* — I. 500cc. evaporated to dryness over a water-bath gave 0.0267gr. of solid residue; of which 0.0122gr. were expelled by ignition, and 0.0050gr. of the remainder insoluble in boiling water. — II. 500cc. over a water-bath gave a solid residue of 0.0267gr.

"*Croton River Water.* — 500cc. evaporated to dryness over a water-bath gave, of solid residue, 0.2175gr.; of which 0.1496gr. were expelled by ignition.

"*Fairmount Water, Schuylkill River.* — 500cc. evaporated to dryness over a water-bath gave, of solid residue, 0.3007gr.; of which 0.1032gr. were expelled by ignition, and of the non-volatile matters 0.0239gr. were insoluble in boiling water.

"*Jamaica Pond Water.* — 500cc. evaporated to dryness over a water-bath gave, of solid residue, 0.0268gr.; of which 0.0115gr. were expelled by ignition, and of the non-volatile matters 0.0070gr. were insoluble in boiling water.

"*Troy Reservoir Water.* — 500cc. evaporated to dryness over a water-bath gave, of solid residue, 0.0593gr.; of which 0.0181gr. were expelled by ignition, and of the non-volatile matters 0.0278gr. were insoluble in boiling water.

"The above results are expressed in tabular form in Table I.

"The following tables of results will sufficiently explain themselves. They exhibit quantities of lead which, for practical purposes, have little more than relative value in the columns in which they occur.

"The experiments were made with bars of lead cast in a common mould, of uniform diameter and length. The quantities of water were constant, or as nearly so as might be, in the same series of experi-

ments. The bars were covered, in test-tubes of a given diameter, with fifteen cubic centimetres.

"After exposure out of direct sunlight, except where otherwise stated, a length of time indicated in the column of days at the left, a suite of similar tubes was filled to the requisite depth with corresponding waters, and the bars transferred with the least delay.

"The waters were then acidulated with acetic acid, received each a drop of acetate of potassa, — which Fresenius has observed decomposes all lead salts not decomposed by hydrosulphuric acid, — and exposed to a stream of washed hydrosulphuric acid till the liquid became clear, if it had been at first discolored by the precipitate of lead. If concentration occurred, it is so stated. The quantities were estimated by a method to be described farther on.

"TABLE I.

	Residue.	Loss upon being Ignited.	Inorganic Matter.	Insoluble after Ignition.
	gr.	gr.	gr.	gr.
Distilled water,	0.0000	0.0000	0.0000	0.0000
Albany "	0.0924	0.0198	0.0726	. . .
Cambridge "	0.3918	0.0990	0.2928	0.0676
Cambridge water that acts on lead,	0.1380	0.0540	0.0840	. . .
Cochituate water,	0.0267	0.0122	0.0145	0.0050
" "	0.0267	. . .	. . .	. . .
Croton "	0.2175	0.1496	0.0679	. . .
Fairmount "	0.3007	0.1032	0.1975	0.0239
Jamaica "	0.0268	0.0115	0.0153	0.0070
Troy "	0.0593	0.0181	0.0412	0.0278

"TABLE II. — *Experiments with Lead to ascertain the Action of Water on Successive Days.* — One bar resting on the bottom of each test tube. Waters replaced at the date of each result.

Days.	Cochituate.	Croton.	Fairmount.	Jamaica.
1	5.000	2.000	7.000	10.000
3	0.500	0.500	0.000	10.000
4	1.000	0.500	2.000	0.000
5	10.000	2.000	5.000	1.000
6	0.100	0.100	0.100	0.500
7	0.100	0.100	0.100	0.100
8	0.200	0.200	0.200	3.000
11	0.100	0.100	0.100	1.000
12	0.100	0.100	0.200	0.500
13	0.000	0.000	0.100	0.500

" The first modification of the experiment was in the extent of surface of lead.

" TABLE III. — *Experiments with Two Bars of Lead.* — In all other respects the conditions were the same as in the foregoing experiments.

Days.	Cochituate.	Croton.	Fairmount.	Jamaica.
1	5.000	5.000	1.000	10.000
3	3.000	2.000	1.000	2.000
4	0.500	0.500	1.000	0.000
5	0.100	0.100	0.100	0.100
6	0.100	0.100	0.100	0.010
7	0.100	0.100	0.010	0.200
8	0.100	0.100	0.010	3.000
11	0.100	0.100	0.100	1.000
12	0.100	0.200	0.100	5.000
13	0.100	0.200	0.200	5.000

" TABLE IV. — *Experiments with Three Bars.* — Other conditions same as before.

Days.	Cochituate.	Croton.	Fairmount.	Jamaica.
1	1.000	0.500	0.500	10.000
3	10.000	2.000	1.000	4.000
4	5.000	0.500	3.000	40.000
5	0.000	0.500	1.000	15.000
6	1.000	0.200	0.100	10.000
7	0.500	0.100	0.100	8.000
8	0.100	0.100	0.100	4.000
11	0.100	0.200	0.200	2.000
12	0.100	0.100	0.100	5.000
13	0.100	0.200	0.100	3.000

" From the foregoing experiments it was deducible, —

" 1st. That the action upon lead was most energetic during the first few days of exposure.

" 2d. That the differences between the action on one, two, and three bars, the volume of water remaining the same, being inconsiderable, the action could not be dependent upon the *surface* of lead exposed, but upon some other constant condition.

" The observation, that, where the bar touched the containing tube, the action seemed most vigorous, suggested an explanation of the want of

uniformity in results. It further suggested experiments with *suspended bars*, the results of which are detailed in the following table.

" TABLE V. — *Experiments with Bars suspended out of Contact with the containing Vessel.* — Waters not exposed to sunlight. Average results of four series of experiments. One bar to each tube. No concentration.

Days.	Cochituate.	Croton.	Fairmount.	Jamaica.
1	15.500	1.500	0.280	80.000
2	0.012	0.012	0.012	2.750
3	0.012	0.001	0.000	0.027
4	0.000	0.000	0.000	0.000

" These experiments and the foregoing seemed to show that, without contact of the solid metal with the containing vessel, the influence of the 'constant condition' was so far enfeebled, after the first few days, as not to have its effects recognized by the ordinary reagents, without concentration, after a period of twenty-four hours' exposure. The following table of results confirms this deduction.

" TABLE VI. — *Experiments with Water several Weeks exposed to Light and the Warmth of the Apartment in which the Experiments were made, by which much of the contained Air had been expelled.* — Bars suspended out of contact with the tube. Volume as in the preceding experiments.

Days.	Cochituate.	Croton.	Fairmount.	Jamaica.	Distilled Water.
1	1.000	0.500	0.000	0.050	25.000
3	0.050	0.010	0.000	2.000	15.000
5	0.010	0.000	0.000	0.050	15.000
7	0.000	0.000	0.000	0.000	15.000
9	0.000	0.000	0.000	0.000	15.000
12	0.000	0.000	0.000	0.000	15.000
17*	0.020	0.010	0.000	0.000	30.000
24*	0.050	0.000	0.000	0.000	0.500
39*	0.500	0.000	0.100	0.100	3.000

" As the street mains are of iron, it was desirable to know if the contact of lead with iron could be more injurious to Cochituate than to Croton, Fairmount, or Jamaica water. Experiments were also made with Albany and Troy reservoir waters, and the Cambridge well-water first in the order of succession in Table I.

* Water concentrated to one fourth of its volume.

"Table VII. — *Experiments with Lead and Iron.* — Iron uppermost. Lead solder. Volume of water as in previous experiments.

Days.	Distilled Water.	Albany.	Cambridge.	Cochituate.	Croton.	Fairmount.	Jamaica.	Troy.
3	8.000	1.000	2.000	1.000	1.000	10.000	10.000	25.000
7	10.000	0.010	0.010	0.010	0.010	0.010	0.500	0.000
9	2.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
20	0.000	0.100	0.000	0.100	0.000	0.000	0.100	0.000
30	1.000	0.400	0.500	0.800	0.500	0.500	0.500	0.100
48	0.100	0.005	0.100	0.010	0.050	0.000	0.010	Lost.

"The discoloration of the bars of lead was least in this order: — Albany, Cambridge, Croton, Fairmount, Distilled Water, Jamaica, Cochituate. That is, Cochituate, apparently, most promptly and completely coats the lead.

"Table VIII. — *Experiments with Lead and Iron.* — Lead uppermost. Lead solder. Volume of water same as in previous experiments.

Days.	Distilled Water.	Albany.	Cambridge.	Cochituate.	Croton.	Fairmount.	Jamaica.	Troy.
2	0.500	0.500	0.500	0.500	0.500	0.500	0.500	0.500
3	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
16	0.010	0.010	0.100	0.010	0.010	0.010	0.010	0.010
26	0.500	0.100	0.010	0.010	0.010	0.010	0.010	0.010
44	3.000	0.050	0.100	0.100	0.100	0.100	0.100	Lost.

"Sections of each bar at first less coated near the iron. Larger measure of protoxide of iron in Cochituate and Croton waters than in the others, as indicated by ferrocyanide of potassium. Discoloration of the bars least in this order: — Fairmount, Distilled Water, Albany, Troy, Croton, Jamaica, Cochituate.

Table IX. — *Experiments with Lead and Iron.* — Soft solder. Volume and other conditions as in previous experiments.

Days.	Distilled Water.	Albany.	Cambridge.	Cochituate.	Croton.	Fairmount.	Jamaica.	Troy.
3	10.000	6.000	6.000	6.000	1.000	10.000	7.000	7.000
12	. .	1.000	Lost.	1.000	1.000	1.000	1.000	2.000
17	30.000	0.000	0.050	0.010	0.500	0.000	0.500	0.000

"As the stopcocks will, many of them, be of brass, it was important to ascertain the influence of this connection.

"TABLE X. — *Experiments with Lead and Brass.* — Surfaces of lead and brass nearly equal. Volume of water as before mentioned.

Days.	Distilled Water.	Albany.	Cambridge.	Cochituate.	Croton.	Fairmount.	Jamaica.	Troy.
1	5.000	2.000	0.500	0.800	25.000	0.100	1.000	5.000
3	8.000	2.000	1.500	1.500	2.000	1.500	1.500	8.000
7	20.000	0.800	10.000	10.000	2.000	1.500	20.000	7.000
33	10.000	0.100	7.000	0.200	0.100	0.100	4.000	7.000
37	20.000	0.800	10.000	2.000	10.000	1.000	8.000	5.000
38	12.000	—	—	0.800	0.800	—	0.400	—
39	2.000	—	—	0.800	0.300	—	0.400	—
40	1.250	—	—	0.400	0.600	—	0.800	—
41	1.500	—	—	—	0.250	—	0.800	—
43	2.000	—	—	1.200	0.500	—	0.800	—

"As some stopcocks may be of copper, a suite of experiments was made to ascertain the effect of this union.

"TABLE XI. — *Experiments with Lead and Copper.* — A bar of lead and copper nail three fourths of an inch long. Lead solder.

Days.	Distilled Water.	Cochituate.	Croton.	Fairmount.
1	5.000	0.500	0.500	0.100
3	1.500	8.000	0.150	0.500
7	20.000	2.500	1.000	1.000
14	25.000	7.000	1.000	1.000
39	10.000	1.000	1.000	1.000
40	1.500	1.000	1.000	0.250
44	1.200	0.500	0.500	1.500
45	2.000	0.200	0.300	2.000
46	5.000	0.800	0.800	3.000
47	3.000	0.050	0.020	1.500
49	2.300	0.010	0.800	2.000

"TABLE XII. — *Experiments with Lead and Tin.* — A half-bar of each soldered without alloy. Volume of water as before mentioned.

Days.	Distilled Water.	Albany.	Cambridge.	Cochituate.	Croton.	Fairmount.	Jamaica.	Troy.
1	40.000	0.500	0.500	0.500	0.500	0.500	0.500	0.500
8	60.000	0.100	0.100	0.100	0.200	0.500	0.800	0.500
32	50.000	1.500	4.000	0.500	0.100	1.500	2.000	—
36	12.000	—	—	0.050	0.050	—	1.500	—
38	1.500	—	—	0.500	1.500	—	3.000	—
39	2.000	—	—	0.500	0.300	—	0.400	—
40	0.500	—	—	0.500	0.500	—	0.700	—
41	2.000	—	—	0.010	0.010	—	0.010	—
43	3.000	—	—	0.010	0.020	—	0.700	—

" Variation in some of the properties of the Cochituate water might be expected to take place. First, *in the percentage of organic matter.* Second, *in temperature.* Third, *in percentage of salts.*

" The effect of increasing the percentage of organic matter is exhibited in the following table.

" TABLE XIII. — *Experiments with Lead in graduated Solutions of Organic Matter (Tannin) in Cochituate Water.*

Days.	Cochituate.	Cochituate and $\frac{1}{100}$ of Tannin.	Cochituate and $\frac{1}{1000}$ of Tannin.	Cochituate and $\frac{1}{10000}$ of Tannin.	Cochituate and $\frac{1}{100000}$ of Tannin.	Distilled Water.
3	1.000	0.800	0.400	0.600	0.600	5.000
5	0.000	20.000*	0.500	0.250	0.250	20.000
6	0.500	2.000	0.500	0.100	0.100	4.000
7	0.000	2.000	0.200	0.000	0.000	3.000
8	0.050	0.500	0.100	0.000	0.000	2.500
10	0.000	0.500	0.000	0.000	0.100	3.000
11	0.000	0.000	0.000	0.000	0.000	2.000
12	0.100	0.000	0.000	0.000	0.000	3.000
13	0.050	0.000	0.000	0.000	0.000	2.000

" The bars of the third and fourth columns became more or less coated with a loose reddish-brown coat of organic matter and lead. The influence of increased organic matter of this form (which is as nearly allied to the vegetable matters that might be expected to occur in lake water as could be readily found) was to lessen the action on lead. The organic matters of lake and river waters consist of living and deceased organisms, animal and vegetable, and of soluble substances derived from decaying vegetation. When exposed a sufficient length of time, these matters become thoroughly inorganic. The carbon becomes carbonic acid, and the hydrogen becomes water, by the consumption of oxygen in solution in the water.

" My experiments have shown, that, if the quantity of organic matter, such as the extract of bark, be more than $\frac{1}{10000}$ of the weight of the water, precipitates of the organic matter in combination with oxide of lead, if any is in solution, will take place. This is one of the methods frequently resorted to for separating organic bodies from solutions.†

* A kind of fungous or flocculent mass fell with the lead, augmenting the volume of the precipitate.

† This precipitate is visible in Croton service-pipes five years in use. It occurs in the Jamaica service-pipes in Boston, and, I have been informed, in those of Fairmount water in Philadelphia.

"The effect of temperature was sought in a variety of ways.* The following experiments are recorded.

"TABLE XIV. — *Experiments with Bars previously coated, exposed to direct Sunlight from the 21st to the 26th of June.* — Bars resting on the bottom of the tubes.

Days.	Cochituate.	Croton.	Jamaica.	Distilled Water.
1	0.100	0.200	3.000	3.000
2	0.250	1.500	2.000	2.000
3	0.100	0.400	2.000	1.000
4	0.050	1.000	1.500	2.000

"The influence of extreme temperature and exposure to air and moisture, under the most favorable circumstances, was ascertained by transmitting steam mixed with air through a leaden pipe thirty-six feet long, coiled like a still-worm, and placed in cold water to produce condensation. One hundred and ten cubic centimetres of the condensed water, after acidulation with acetic acid, were treated with a stream of hydrosulphuric acid. The precipitate was collected on a filter, previously dried at 100° C., and gave 0.0225gr. of sulphide of lead, equal to 0.0196gr. of lead; which is equivalent to 0.8095gr. of lead in a gallon. Whatever influence might result from such changes, it must be remembered that pipes under ground will preserve a tolerably even temperature; and be the effect of increased heat what it may, it has been *more* energetic in Philadelphia than it ever can be in Boston.

"The effect of increasing the percentage of common salt is exhibited in the following table.

"TABLE XV. — *Experiments with Cochituate Water and graduated Solutions of Common Salt.* — Bars and volumes as in the foregoing experiments. No concentration. Bars resting on the bottom of the tubes.

Days.	Pure Cochituate.	Cochituate and $\frac{1}{100}$ of Chloride of Sodium.	Cochituate and $\frac{1}{1000}$ of Chloride of Sodium.	Cochituate and $\frac{1}{10000}$ of Chloride of Sodium.	Cochituate and $\frac{1}{100000}$ of Chloride of Sodium.
1	2.00	.20	.30	1.60	2.00
2	1.80	.10	.15	.60	1.20
3	.20	.10	.08	.08	.30
8	.30	2.50	1.20	.30	.50

* Dr. Hayes has observed that elevation of temperature increases the quantity of lead dissolved in a given time. — *Report of the Consulting Physicians*, 1848, p. 24.

"These results show, —

"1st. The immediate effect of the salt in preventing the action on lead by lessening the solvent power for air; and

"2d. The influence of salt in dissolving the coat formed, by double decomposition, or by the formation of the double salt of the oxide and chloride; as shown in the last suite of results.

"The preceding experiments, as a whole, go to *show that Cochituate water may be distributed through iron mains and leaden service-pipes with as little danger as Schuylkill, Croton, or Jamaica water.*

"The consideration that was to give value to these determinations was that of the health of the citizens of Philadelphia, New York, and Boston, so far as it might be influenced by the waters served through lead in the respective cities. This was to be decided, as already intimated, by an appeal to the most enlightened testimony that could be furnished; that of eminent physicians of extensive practice in the localities where lead pipe is employed."

Professor Horsford then adduced a summary of the numerous medical opinions, chiefly compiled from letters addressed to himself, and which have been already published in the Appendix to the Water-Commissioners' Report of August 14th, 1848.

"The decision of this question does not depend upon the presence or absence of a minute quantity of lead in water that has been standing a given length of time in leaden pipes, or upon the *absolute* freedom from corrosion of pipes long in use. For if a certain quantity, more or less, has found its way into the human system in the every-day regular use of Croton and Schuylkill waters, then must the human system be capable of sustaining without injury this quantity; and the possibility of receiving an equal quantity hereafter by those who drink Cochituate water may be contemplated without solicitude, since the experiment has been made.* Nevertheless, examinations for lead have been made in many well-waters, and also in Croton, Jamaica, Schuylkill, and Troy waters, and Dedham spring water. The results follow.

* To this point more particular reference will hereafter be made.

"TABLE XVI. — *Determinations of Lead in Well-waters served through Leaden Pipes in Cambridge.*

	Volume.	Hours Exposed.	Reduced Volume.	Sulphide of Lead.
				gr.
a	100cc.	36	10cc.	0.000
"	200	36	10	0.000
"	300	36	10	0.000
b	500	12	16	0.000
c	100	12	10	Precipitate.
"	50	12	10	"
"	40	12	10	"
"	30	12	10	0.000
	gallon	12	10	0.100
d	500cc.	12	5	0.000
e	100	12	5	Precipitate.
	gallon	12		0.080
f	300cc.	12	5	Precipitate.
	gallon	12		0.0004
g	500cc.	12	20	0.000
h	200	36	5	0.00005
	gallon			0.00113
i	300cc.	12	10	0.0009
	gallon			0.0136

"*Well in Boston.* — 200cc., first drawn in the morning, gave, when concentrated to 5cc., 0.00003gr. = 0.00068gr. in a gallon. Dr. Charles T. Jackson has detected lead in a well-water in Waltham.

"*Well in Dedham.* — 100cc. of water standing over night in the pipe serving from the reservoir supplied by a forcing-pump, concentrated to 5cc., gave a trace of lead.

"Water supplied from the spring in Dedham, which is known to have corroded leaden pipes, and poisoned at least one individual. — 100cc., at rest twelve hours in leaden pipe several years in use, gave 0.00003gr. = 0.0013gr. in a gallon. Several years since, my friend, Dr. Webster, examined some of this water from the pipes of the gentleman who was made ill, and detected lead, without concentration, by treatment with sulphide of ammonium.* This branch pipe was 150 feet in length. The main pipe, two inches in diameter, is about three quarters of a mile long. This pipe must be capable of holding a gallon in a little more than seven and one third feet, or 540 gallons in its whole length. Thus, the entire morning draught of *spring water* of each

* Such was the quantity of lead in solution, that a white film (of carbonate and hydrate of lead) rose to the surface of this water, after being drawn a short time.

family had ordinarily been at rest twelve hours in the main and lateral pipes. In some instances it had doubtless been longer at rest; and yet, so far as I have been informed, but one well-established case of lead disease is known to have occurred from the use of this water.

" TABLE XVII. — *Determinations of Lead in the Croton Water of New York.* — Drawn, after thirty-six hours' exposure, from leaden pipes, at seven different localities, in the neighbourhood of John Street.

Bottles.	Volume.			Volume.					
1.	500cc.	reduced	to	10cc.	gave,	of Sulphide	of	Lead,	00
2.	"	"	"	"	"	"	"	"	00
3.	"	"	"	"	"	"	"	"	00
4.	"	"	"	"	"	"	"	"	00
5.	"	"	"	"	"	"	"	"	00
6.	"	"	"	"	"	"	"	"	00
7.	"	"	"	"	"	"	"	"	trace.

" 1000cc. derived from bottles 1, 2, and 3, concentrated to 10cc., gave, with hydrosulphuric acid, a precipitate which, ignited with saltpetre and redissolved, gave, with bichromate of potassa and hydrosulphuric acid, distinct precipitates of lead. The whole quantity equalled about 0.0001gr., or for a gallon 0.00045gr.

" *Determination of Lead in the Schuylkill Water of Philadelphia.* — According to Professor Booth, 100 apothecaries' ounces, after exposure 36 hours in leaden pipe, a year and a half in use, concentrated to the bulk of half an ounce, gave not the slightest discoloration after transmitting hydrosulphuric acid through it for an hour.

" *Troy Reservoir Water.* — 2000cc., 24 hours at rest in leaden pipes several years in use, gave, when concentrated to one hundredth of its volume, no trace of lead.

" TABLE XVIII. — *Determinations of Lead in Jamaica Water served through leaden Pipes in the City of Boston.*

" April 13th.			Exposed to the Lead.			Gave of Sulphide of Lead.
No. 6 Hudson Street,		200cc.,	12 hours,	reduced	to 20cc.	00
No. 10 "	"	"	"	"	"	00
No. 98 "	"	"	"	"	"	00
No. 800 Washington Street,		"	"	"	"	00
No. 10 Tyler Street,		"	"	"	"	00

" April 13th. Worcester Railroad Depot, 1000cc., exposed to the lead 36 hours, reduced to 20cc. gave, of sulphide of lead, 00gr.

"June 19th. Worcester Railroad Depot, 500cc., exposed to the lead 36 hours, reduced to 5cc., gave, of sulphide of lead, 0.00002gr.* = 0.00018gr. in a gallon.

"The magnitude of this quantity, and the influence its known presence in a water should have, may be over-estimated.

500	cubic	centimetres	contain	0.00002gr.
1000	"	"	"	0.00004gr.

"Wiesbaden water contains of arsenious acid, in 1000cc., 0.00045gr.,† —a quantity more than ten times as great as the lead in Jamaica water, and yet this water is renowned for its medicinal virtues. It may be said, that the arsenic is in combination with oxide of iron. Chevallier and Gobley have come to the conclusion, that its occurrence in springs is not dependent upon the presence of iron.‡ It is found in water whose character is determined by the presence of carbonic acid or sulphates. This body occurs in *solution* in waters from nine mineral springs in France. Its occurrence in Germany has been recognized, among others, by Will.§ Tripier found it in Algiers.

"The appearance of leaden pipes taken up after several years' use, in New York, is what might have been expected. I have examined twelve pieces from as many different localities. Most of the specimens that had been in use for only one and two years were covered with a bluish-gray coat, and some of them could scarcely be distinguished from ordinary pipe for sale in the shops. A specimen in use five years is coated with a transparent, exceedingly thin, reddish-brown film, apparently composed of organic matter, oxide of lead, and oxide of iron. The crystalline laminæ upon the inner surface, characteristic of new pipe, are to be seen with the utmost distinctness, and present, with the exception of the coating, no appearance distinguishing it from new pipe.

"Jamaica pipe, in use from fifteen to twenty years, is coated with a thick, reddish coat, which, when dry, may be readily disengaged, and in one specimen examined shows traces of slight corrosion beneath. The corrosion from without was such as to have nearly eaten through in some places. The lead of this pipe contained great proportions of antimony where corrosion occurred, but no sulphide of lead, which, I am informed, occurs in much lead pipe.

* Precipitate ignited, redissolved, and re-precipitated.

† *Compt. Rend.*, Tom. XXIII., pp. 612-615, 634, 635.

‡ *Journ. de Ph. et de Ch.*, 3 Ser., Tom. XIII., pp. 324-333.

§ *Ann. der Chem. und Pharm.*, LXI., pp. 192-204.

"Pipe employed to conduct Dedham spring water is internally corroded, and presents at intervals deep depressions, the result of more extreme local action. Pipe of one well in Cambridge is appreciably corroded. Pipe of wells in Boston is frequently consumed in periods of from six to eighteen months.

"The above results and observations show, that, —

"1st. Many well-waters, in a space of time comparatively short, act on lead. This has been fully established by the researches of Dr. Dana * in this country, and by observations in England.

"2d. That, except after longer exposure than will ordinarily occur in actual use, the amount of lead coming into solution in Croton, Schuylkill, or Jamaica waters is too small to occasion any solicitude.

"Hence it may be inferred from the above, and from the great similarity of Cochituate to Jamaica, Croton, and Schuylkill waters, in its relations to lead, that *the quantity of lead that will be dissolved in Cochituate water in actual service will, for all practical purposes, be of no moment.*

"The recognition and quantitative determination of very minute quantities are not always without difficulty; where many and rapid determinations are required, the processes of gathering upon a filter, washing, drying, igniting, and weighing consume far too much time, and are sometimes less accurate than other and more indirect methods. That which I have employed is based upon the mode of analyzing silver coin proposed by Gay-Lussac, † and adopted quite universally at mints. The same general method has been extended by Gay-Lussac to ascertain the strength of alkalies and bleaching-powder. It is employed with protosulphate of iron and subchloride of mercury for the latter purpose. It is the method of graduated solutions. A gramme of lead in the form of the acetate (common sugar of lead), which contains three atoms of water, is dissolved in 100 grammes or parts of distilled water. This constitutes solution No. 1. Ten parts of this solution are diluted with ninety parts of water to make solution No. 2. Ten parts of solution No. 2, diluted with ninety parts of water, make solution No. 3. In the same manner solutions No. 4, No. 5, and No. 6 are prepared.

"Ten parts of each solution are placed in corresponding test-tubes (about six inches long, five eighths of an inch wide, and closed at one end), and hydrosulphuric acid transmitted through them till the liquid,

* Appendix to Tanquerel, by Dana.

† *Annales de Chemie et de Physique.*

first blackened by the formation of sulphide of lead, becomes clear. Test-tube No. 1 contains one tenth of a gramme of lead in the form of sulphide, — a black powder at the bottom. Test-tube No. 2 contains one hundredth of a gramme. No. 3, one thousandth. No. 4, one ten-thousandth. No. 5, one hundred-thousandth. No. 6 yielded no precipitate without concentration. Each succeeding precipitate in the series, setting aside a slight allowance to be made on account of solubility, was one tenth as voluminous as the one above.

"Having prepared this scale of quantities, it is required to determine the amount of lead in a given diluted solution. An experiment is made to ascertain if the quantity be large enough to give a direct precipitate with sulphide of ammonium. This being decided in the negative, fifty cubic centimetres or grammes of water (corresponding with fifty parts of the scale of solutions) are carefully evaporated to dryness and ignited in a small porcellain capsule (to expel any organic matter that may have been present), moistened with nitric acid, and then warmed, with the addition of acetic acid and water, till the volume becomes ten cubic centimetres. A drop of acetate of potassa is then added, and then hydrosulphuric acid gas transmitted through the solution. A precipitate results, or it does not. If it does, to know its value or the amount of lead it contains, the scale is resorted to. Though it might rarely be possible to identify it with either one of two precipitates in the scale, there could be no difficulty in deciding between which two it should fall, or nearest to which one of two it should be placed. If fifty cubic centimetres thus treated yielded no precipitate, one hundred cubic centimetres were evaporated to dryness, and the residue similarly treated. If this failed, five hundred cubic centimetres were taken, and in some instances more, and the same course pursued.

"It was natural to suppose that the presence of foreign bodies, such as occur in natural waters, might embarrass the precipitation. This led to the preparation of a series of graduated solutions of lead, with all the common salts occurring in waters, from the reagents in my laboratory. They were similarly treated with acetate of potassa, free acetic acid, and a stream of hydrosulphuric acid, and though it was possible to see differences in the amounts of the precipitates, they fell very greatly within the differences between the successive members of the graduated series.

"The precipitates in the experiments with bars of lead, the results of which are given in the preceding tables, were estimated from this scale.

They were, however, not ignited and redissolved, as in the examination of waters exposed in lead pipe, and the numbers were intended, as already remarked, to express only relative values.

"*Influence of Nitrates.* — Although medical testimony and public sentiment were conclusive upon the subject of the health of our larger cities, so far as it might be influenced by the lead contained in the reservoir-waters used for culinary and general purposes, it was equally certain that individuals had been poisoned from drinking the waters of wells, and in one case, at least, from drinking water from a spring. It was obvious, therefore, that between these two classes, river, lake, pond, and open reservoir waters on the one hand, and well and some spring waters on the other, there must be differences in their relations to lead. Experiments were made with well-water, and at the same time with the river and lake waters in my possession. The following result shows with what success.

TABLE XIX.

Days.	Well-water.	Cochituate.	Fairmount.
3	1.00	1.00	.15
5	.20	.00	.60
6	.30	.50	.00
7	.10	.00	.00
8	.00	.05	.00
10	.50	.00	.00
11	.00	.00	.00

"The bars rested on the bottoms of the tubes, and the waters had been some time standing in sunlight. These experiments threw little light upon the subject. The differences in favor of the Cochituate and Fairmount, as compared with a well-water known to act vigorously on lead pipe, were too inconsiderable to be worthy of notice. These waters contained in 500cc.

	Of Solid Residue.	Of Organic Matter.	Of Inorganic Matter.
Well water,	0.1380gr.	0.0540gr.	0.0840gr.
Cochituate,	0.0267	0.0122	0.0145
Fairmount,	0.3007	0.1032	0.1975

"On comparing these, it will be seen that the water which contained the most solid residue acted least on lead, and that the action of that which contained least solid residue was next in order. The comparison of the analyses of waters made by different individuals led to no satisfactory results. Ingredients that might have been presumed to

be in all had in some cases not been recognized. The only large suite of analyses made by a single individual first fell under my eye in the early part of June of 1848. In the following table are compared the average total amounts of inorganic matters, and also the relative amounts of the more prominent salts, in three wells, six springs, and six rivers, as determined by Deville.*

	Total.	Nitrates.	Chlorides.	Sulphates.	Carbonates.
Wells,	6455	1701	650	1394	2291
Springs,	3344	86	77	365	2336
Rivers,	1949	65	38	157	1185

" The compounds of sulphuric and carbonic acids with oxide of lead are eminently insoluble. The chlorides are less insoluble, and the nitrates are highly soluble.† The contrast between the quantities of nitrates in well and river waters suggested the experiment with lead and graduated solutions of saltpetre.‡ The results follow.

TABLE XX.

Days.	Pure Cochituate.	Cochituate and $\frac{1}{1000}$ of Saltpetre.	Cochituate and $\frac{1}{10000}$ of Saltpetre.	Cochituate and $\frac{1}{100000}$ of Saltpetre.	Cochituate and $\frac{1}{1000000}$ of Saltpetre.
1	1.00	1.00	2.25	0.75	0.50
2					
3	0.00	2.00	1.00	0.50	0.10
4	0.50	2.00	0.25	0.10	0.10
5	0.00	2.50	1.00	0.30	0.20
6	0.05	2.50	0.50	0.30	0.00
7					
8	0.00	2.00	0.80	0.05	0.00
9	0.00	1.80	0.70	0.00	0.00

* *Ann. de Chem. et de Phys.*, 3e Série, Tom. XXIII., pp. 33-47.

† Sulphate of lead is soluble in not less than 15000 parts of water. GMELIN. — Carbonate of lead requires 50551 parts of water. FRESENIUS, *Ann. der Chem. und Phar.*, LIX., S. 117-128. — Chloride of lead requires 135 parts of pure water, 534 of water containing chloride of calcium, and 1636 of water containing hydrochloric acid. BISCHOF. — Nitrate of lead dissolves in 1.989 parts of water at 63° Fahr. KARSTEN. — A solution of saltpetre containing 39 parts to 100 of water will still dissolve 110 parts of nitrate of lead. — GMELIN.

‡ O'Henry found nitrates in mineral spring-water in 1839. *Journ. de Pharm.*, Dec., 1838, pp. 634-637. — Liebig found nitrates in twelve wells in Giessen, and none in the wells of the surrounding country, by experiments made in 1827. " This fact has been noticed by Berzelius in Europe. I," says Dr. Dana, " have

TABLE XXI.

Days.	Pure Fairmount.	Fairmount and $\frac{1}{1000}$ of Saltpetre.	Fairmount and $\frac{1}{10000}$ of Saltpetre.	Fairmount and $\frac{1}{100000}$ of Saltpetre.	Fairmount and $\frac{1}{1000000}$ of Saltpetre.
1	0.15	1.00	0.80	0.80	0.80
2					
3	0.60	3.00	1.25	0.25	0.20
4	0.00	1.80	0.50	0.00	0.00
5	0.00	2.25	1.50	0.40	0.10
6	0.00	1.80	0.80	0.05	0.00
7					
8	0.00	2.50	0.80	0.20	0.05
9	0.00	1.80	0.80	0.20	0.00
10	0.00	1.80	0.80	0.20	0.10
11	0.00	1.20	0.80	0.00	0.00

"The mode of action of the saltpetre has been the subject of experiment. I had previously exposed bright bars of lead to natural waters containing traces of nitrates, which were deprived of air and sealed in glass flasks. Months had produced no action upon the lead, and had conducted to the opinion, that lead was not acted upon by nitrates in natural waters. As the reaction of the Cochituate or Fairmount water was perfectly neutral, the decomposition of the saltpetre by free acid, which should expose the lead to uncombined nitric acid, was not possible. Fresenius had observed that the carbonate of lead was less soluble in water containing nitrate of ammonia and ammonia than in pure water. I was aware that alkaline chlorides promoted the solution of certain lead compounds, and it occurred to me that they might be more soluble in waters from the presence of nitrate of potassa, soda, or lime.

"In changing the waters, from day to day, exposure to the air would furnish the oxygen and carbonic acid more directly than the absorption from the surface, for the formation of the hydrated oxide and carbonate, and these might to a slight extent, it seemed possible, experience

confirmed it in the water of a great number of wells in Lowell." *Appendix to Tanquerel*, p. 367. — Guyton Morveau, most of whose labors belong to the last century, mentions saltpetre as one of the salts denominated by him protecting in its influence on leaden pipes, when seeking to find the value as protectors of the different salts occurring in natural waters. CHRISTISON. — Dr. Dana has ascribed a prominent place to nitrates and chlorides in the action of well-waters upon lead. *Appendix to Tanquerel.* — Experiments with graduated solutions of common salt were made. See p. 74.

decomposition with the saltpetre. The decision of this point rested upon the following experiments.

"1. A solution of saltpetre, the usual laboratory reagent, was poured upon a quantity of common white lead, and, after repeated agitation and alternate rest, filtered off and tested with hydrosulphuric acid for lead. There followed an instantaneous, distinct, though not large, precipitate of sulphide of lead. There was an objection to the experiment. White lead prepared from the acetate might not be altogether free from acetate of lead. This, if present, might be brought into solution by the nitrate of potassa.

"2. To settle this point, a portion was carefully ignited upon platinum. Had there been appreciable acetic acid, the mass would have more or less blackened, or would have revealed to the sense of smell some evidence of its presence. It gave no indication whatever.

"3. A quantity of the white lead was then treated with sulphuric acid and alcohol in a test-tube, in the usual manner for detecting acetic acid by the formation of acetic ether. This failed to give a trace of acetic acid. The quantity of white lead was small.

"4. Four ounces of white lead were then boiled three hours with a large measure of diluted soda, filtered, concentrated, and treated with sulphuric acid and alcohol as before. It yielded no distinct trace of acetic acid.

"5. To meet the question fully, and give to the experiment the advantage of the nascent state which in actual practice must occur, and to give to the view an entirely unobjectionable foundation, I added to a solution of nitrate of lead, first, potassa, which threw down a hydrate of lead, and then carbonate of potassa, which threw down a carbonate of lead, until the solution yielded an alkaline reaction. There were then hydrate and carbonate of lead in the precipitate, and nitrate of potassa, carbonate of potassa, and if any lead, a nitrate of lead in solution. The liquor was filtered, and, upon adding hydrosulphuric acid to the filtrate, I obtained a precipitate of the black sulphide, more voluminous than in the first experiment with white lead and a solution of saltpetre.

"6. Soda and carbonate of soda gave the same reaction.

"7. Nitrate of lime in solution gave the same reaction as nitrate of potassa.

"My attention has been drawn by a friend to the following sentence in Berzelius: — 'When nitrate of lime is boiled with carbonate

of lead, the oxide of lead is dissolved, while the carbonate of lime is deposited.' * If with the aid of heat such decomposition results, it might be conceived that, favored by the nascent condition, quantity, and time, there might be to some small extent a corresponding decomposition. The first was the principal experiment bearing on this point made at the date of my last letter to the Water-Commissioners, and upon this experiment, and the known solubility of the nitrate, I ascribed the increased action of water consequent upon the addition of nitrates to a slight double decomposition. It had been ascribed by Dr. Dana † to the conversion of the protoxide of iron, in solution as protosulphate, into the peroxide, by which he conceived there would be free sulphuric acid, and therefore free nitric acid, in water containing protosulphate of iron and nitrates. ‡ This explanation would not apply to the action of neutral waters, or of those containing no protosalts of iron, though nitrates were present. The whole subject has undergone a more thorough examination. The conclusion that nitrates are not reduced by lead I have found to be erroneous; for experiment has shown that upon boiling a strong solution of nitrate of potash to expel the air, and introducing a bar of bright lead, it became immediately coated with suboxide of lead, and this without the evolution of gas. There had been a partial reduction of the nitric acid. Upon testing the solution with hydrosulphuric acid, it gave, after long digestion, but a faint discoloration. Upon pouring off the liquor and adding to it oxide of lead, and continuing the digestion, a large quantity of lead was dissolved, which in 66cc. gave of sulphide of lead 0.0106gr. = 0.7296gr. in a gallon. The solution reacted strongly alkaline. As the only known inorganic salts of nitrous acid are its compounds with lead, it was probable that, upon the reduction of the nitric acid to nitrous acid, it had abandoned

* "Lorsqu'on fait boullir du nitrate calcique avec du carbonate plombique il se dissout de l'oxyde plombique tandis que le carbonate calcique reste." — *Traité de Chemie*, 1847, Tom. IV., p. 91.

† *Report of the Joint Special Committee of City of Lowell*, Aug., 1842, pp. 8-11.

‡ The change that takes place when a solution of copperas is exposed to the air may be thus represented: — $4\,(Fe\,O,\,So_3) + 20 = Fe_2\,O_3,\,3\,S\,O_3 + Fe_2\,O_3,\,S\,O_3$. The latter compound is insoluble in water. GMELIN. — The constitution of the precipitate, according to MITSCHERLICH and SCHEERER, is $2\,Fe_2\,O_3,\,S\,O_3 + 3\,H\,O$. WITTSTEIN (*Buch. Rep.*, 3 R., Bd. I., S. 182-189) gives it as $2\,Fe_2\,O_3 + 3\,So_3 + 8\,H\,O$. An acid salt remains in solution, which is probably what Dr. Dana would have understood from the statement that the above decomposition produces *free* sulphuric acid.

the potash to unite with the oxide of lead, or a basic soluble salt had been formed, in which potash was present. Upon examining the nitrate of potash employed as a reagent in the first experiment, and which had been purchased for this purpose because it was labelled *pure*, it was found to contain alkaline chlorides, — a circumstance to which the lead in the first experiment might in part be ascribed. A repetition of it with pure nitrate of potash and the hydrate and carbonate of lead, prepared by exposing lead to distilled water in an open vessel, gave but a faint discoloration with hydrosulphuric acid. I am inclined to ascribe to the reduction of the nitric acid much the greater part in the action of nitrates upon lead.

" *Action of Air.* — The importance of air in order to the action of a water upon lead has been intimated in the results already recorded. The following experiments confirm the observations of Yorke, Bonsdorff, and others, and, more recently, of Dr. Hayes, as expressed in his Report to the Consulting Physicians.*

" Experiment 1. — June 17th. An apparatus consisting of a half-gill flask, containing lead scrapings and Cochituate water, filled to half its depth, the lead all below the surface of the water, was connected by a tube, bent twice at right angles, with a vessel of mercury. The cork uniting the tube and the flask was carefully covered with sealing-wax. If, now, in the oxidation of the lead, oxygen should be withdrawn from the space above the water, mercury would rise to occupy its place. The mercury had risen, June 19th, three fourths of an inch; July 1st, four inches; July 22d, six inches; and in August the mercury passed over into the flask. Another similar apparatus prepared on the 16th of May showed, on the 10th of August, mercury at a height of 6½ inches.

" Experiment 2. — A flask of a half-gill capacity was filled to two thirds its depth with distilled water, and boiled five minutes. While hot, and without delay, bars of bright lead were added, and the flask filled from another flask containing distilled water that had been boiling an equal length of time. In this condition a nicely-fitting cork was adjusted to the neck, and expeditiously sealed, so as to prevent the admission of air. Another flask was filled in the same manner with Cochituate water, and sealed. Both are in possession still. The bar in distilled water is quite as bright as when immersed, except around the end in contact with the glass, which has become a little coated. The

* *Report of Consulting Physicians*, Boston, 1848, p. 23.

bar in Cochituate water was bright for some months, but has at length become slightly dimmed in small patches, which may be attributed to the less complete expulsion of the air by boiling, or the less accurate stopping of the flask, though at the time the experiment was made both were regarded as unobjectionable.

"The following experiment shows how much is due to a change of water. The bars in the Cochituate remained quite bright, and those in the other waters were but slightly coated. Two bars in 15cc. for thirteen consecutive days, without changing the water, gave, in Cochituate, 0.500gr.; Croton, 0.500gr.; Fairmount, 0.500gr.; Jamaica, 1.000gr.

"These experiments seemed to show that, without a renewal of the air, the action nearly or quite ceases after a short time. Professor Silliman, Jr., made a similar observation in his experiments with the various waters submitted to him for analysis by the Water-Commissioners in 1845. He used a large volume of water, and yet the bar remained quite bright. There was no *alternate exposure to water and air*. Christison remarks, that, while certain waters might doubtless be kept with safety in leaden cisterns, the covers of the cisterns should not be of lead, but of wood, since the moisture condensing on them, furnishing, as he observes, *pure* water, would act on the lead, and the product falling would poison the water. The joint action of air and water is here presented under exceedingly favorable circumstances. The corrosion of cisterns along the line where air and water meet might be expected.

"It will be readily seen, from considering the important part air plays, how rain-water must act with great vigor upon lead. It contains air, and is surrounded by air, and, aside from temperature, could not be more favorably constituted for acting upon lead. The well-known prevalence of lead maladies in Amsterdam, while leaden roofs were in use, and the restoration of health on their replacement with tile, find here a ready explanation. Dr. Dana has recorded an experiment with rain-water, which furnishes a valuable confirmation of what is stated above.* In a series of experiments with lead pipe of considerable length, if an interval of half a minute, or even less, occurred between the emptying of the pipe and refilling, there was invariably found lead in the water. This has been observed on a large scale in the practical service of lead pipe. Where from any cause the pipes have been empty for a length of time and then filled, the first water drawn con-

* Appendix to Tanquerel.

tains a very considerable quantity of lead. In the experiments of the preceding tables, the tubes intended to receive the bars were previously filled, and thus the transfer of the bar from one tube to another occupied scarcely a second of time. Even this short period was doubtless adequate to provide for some of the oxidation which the bar experienced.* Important as the office of air is, it is not adequate of itself to oxidate lead. A bar of lead scraped bright and placed in a desiccator over sulphuric acid remained undimmed for weeks, — during the whole time of the experiment.

" *Influence of Light and Organized Substances in Water.* — It is a familiar fact, that well-water recently drawn and exposed to the light and warmth a short time loses much of its air, and becomes insipid. Count Rumford has made this fact the foundation of an important investigation. His conclusions in relation to the joint effect of sunlight and solid miscible, but insoluble, substances in expelling the air from waters, and thus showing a difference between lake, river, pond, and reservoir waters, which are exposed to sunlight, and well or spring waters, which are concealed from it, are of great importance in this connection.† I have made numerous experiments upon this subject, which, although still incomplete, taken in connection with the results of Count Rumford, go to establish the following positions : —

" 1st. Well waters contain more air in solution than lake, river, and pond waters, as a class. 2d. Sunlight and heat falling upon water containing solid insoluble substances, organic tissues, or pulverulent matter, expel a portion of the gases. 3d. The germs of animalculæ being

* I see, in the time between the emptying and filling of leaden pipes employed in experimenting, the explanation of much of the discrepancy between the results of different experimenters. If to this be added the unequal exposures to warmth and light which have been permitted by those engaged in experimenting, I am persuaded that most of the differences in results will be fully accounted for.

† He exposed spring water, containing, in a series of experiments, weighed quantities of raw silk, poplar cotton, sheep's wool, eider-down, hare's fur, cotton-wool, ravellings of linen, and Confervæ (hair-weed), to the sun's rays, and observed the quantity of air disengaged by each substance. It amounted in some cases to *one eighth* of the volume of water. *Philosophical Papers*, by Benjamin, Count Rumford, London, 1802, Vol. I., pp. 218 - 263.

The observations of Wöhler in 1843 (*Ann. der Chem. und Pharm.*, Bd. XLI., S. 121), and of Schultz in 1845 (*Journ. fur Prakt. Chem.*, Bd. XXXIV., S. 61 - 63, 1845), upon the evolution of oxygen from waters containing animalculæ and 'green plants,' under the influence of sunlight, were confirmations of some of the experimental results of Count Rumford.

present, oxygen will be given out and immediately expelled, until the maximum of the solvent power for air by the given temperature be attained. 4th. On the withdrawal of sunlight and the reduction of the temperature, the animalculæ cease to evolve oxygen, and that which is in solution becomes the prey of the decaying organic matters present. 5th. The hydrogen of organic bodies (as Liebig has remarked) oxidates first. This position I have verified by a series of observations, to which I will here only refer.

" The following experiment may be mentioned in this connection. Two clear glass globes of about four and a half inches in diameter, filled with waters from two wells in Cambridge, in one of which, after rest of twelve hours in leaden pipe, lead was detected, and in the other of which, after equal exposure, no lead was recognized, were placed in a window of south-southeast exposure. Into each globe a skein of silk weighing 1.25gr. was introduced ; at the end of five days, the quantity of gas evolved was more than twice as great in that containing the well-water that acted on lead as in the other. No admeasurement of the quantity was attempted, for the following reason : I wished to know what would become of these gases, — the water containing organisms which must soon consume their supply of nutriment. In a period equal to the above, the gases were entirely absorbed, and after the lapse of a month, during which time there were several days of brilliant sunshine, no gases appeared. An isolated experiment of this description cannot have much value. But it seemed to me worth recording, as sustaining what Liebig has remarked, that of the elements of organic bodies the hydrogen is more readily oxidated than the carbon, and as illustrating the decay of organic bodies in water.

" Of the various popular reasons why lead should not be employed for distributing water, the following have been found not to be sustained by experiment or authority.

" 1. *The Galvanic Action of Iron and Lead.* — The effect of contact with iron, in most of its points of view, has been investigated. In diluted acids, *bright* lead in contact with iron is positive, — *coated* lead, *negative.* YORKE. — Diluted acid facilitates the solution of iron in contact with lead. RUNGE. — In strong nitric acid, iron, in connection with lead, is *positive.* DELARIVE. — In potash solution or lime-water, bright lead is positive to iron, but *oxidated* or *coated* lead is *negative.* This is also true of these metals in a solution of saltpetre. YORKE. — It is also true in a solution of sal-ammoniac. WETZLAR. — Thus in *acid*, *al-*

kaline, and *saline* solutions, — all the conditions in which Cochituate water can occur, — iron, if not at first, will, after a short interval, be the metal at whose expense the galvanic action will be sustained.

" 2. *The Action of Iron-Rust.* — It was natural to suppose that the moist iron-rust flowing from the mains into the leaden pipes might, by reduction to a lower oxide, promote the oxidation and solution of lead. Bars of lead in contact with hydrated peroxide of iron, in open tubes, containing Cochituate, Croton, Jamaica, Fairmount, Albany, and Troy water, arranged on the 15th of May, gave, when tested on the 17th, 22d, and 27th of May, and 7th of June, with ferrocyanide of potassium, no indication of protoxide. The same water in which nails were immersed, tested from time to time, gave occasional evidence of the presence of protoxide of iron. I placed peroxide of iron and bright bars of lead in flasks of distilled and Cochituate water, and sealed them, on the 7th of last June. The flasks are in my possession still, and though the air was expelled only so much as boiling five minutes would accomplish, the bars of lead are quite as undimmed as on the day they were sealed up. It is scarcely necessary to state that the iron rust, in actual service, does not come in contact with *lead*, but with the suboxide, or other coat.*

" 3. *The Solubility of the Suboxide of Lead.* — I have been unable to procure the slightest trace of lead in water deprived of its air, after long contact with the suboxide of lead. Mitscherlich remarks of its insolubility.†

" 4. *The Action of Alkaline Chlorides upon Lead, in the Absence of Oxygen or Atmospheric Air.* — The following experiment was made and several times repeated by me with graduated solutions of common salt. A flask of one gill capacity, containing a quantity of lead shavings, presenting an extent of surface comparatively great, was one third filled with a solution of common salt. This flask was connected by a tube, bent twice at right angles, with a cup of mercury. The cork, tube, and neck, at the connections, were carefully covered with sealing-wax, that the flask might be air-tight. So arranged, the flask

* Reference has been made to the experiments of Napier upon this point. He made *no experiments with peroxide* of iron, but with *neutral salts* of the peroxide, and he states distinctly that lead exposed to them a little while became coated, and that action *was thereafter arrested.* — *Lond., Edinb., and Dubl. Philos. Mag.*, May, 1844, pp. 365 - 370.

† *Lehrbuch der Chemie*, 2te Band, S. 511.

was slightly warmed; the air thereby driven out was of course replaced with quicksilver, the upper surface of which, after the original temperature had been reëstablished, was marked. Now, if any decomposition of common salt occurred by the agency of lead, the chlorine would be freed from the sodium, the sodium would decompose the water, hydrogen would be set free, and the column of mercury depressed. Instead of any such result, the column of mercury regularly rose in every instance. An apparatus of this description, several months in action, is still preserved in my laboratory. It might still have been said, that, had the flask been deprived of air, the lead would have been acted on by the simple chloride. The experiment of lead and sea-water, in a flask deprived of air, has been made. The flask was sealed on the 25th of May last. The bar for a long time retained its perfect brightness, and is but very faintly dimmed at this late day, February 1, 1849.

"5. *Action of Organic Matter.* — It has been conceived, that organic matter might exert a deleterious influence. Experiments already recorded (p. 15) show that the presence of organic matter increases the protecting power of water which is to be transmitted through lead. If the quantity exceed one ten-thousandth of the weight of the water, precipitates of oxide of lead, united to organic matter, take place. Orfila has remarked the precipitation of the coloring matter from Burgundy by neutralizing it with litharge.* Its influence in withdrawing the oxygen from solution has also been alluded to. In the important researches of Dr. Smith † upon the air and water of towns, it is mentioned that the presence of nitrates in the London water prevents the formation of organic matter, and that organic matter, in filtering through soils, becomes rapidly oxidated. Additional experiments bearing upon this point are recorded farther on.

"*Influence of Impurities in Water.* — It is a prevailing conviction, that the more impure a water is, or, in general terms, the more salts it contains in solution, the less will be its action on lead. The influence of sulphate of magnesia (epsom salts) and chloride of sodium (common salt) in distilled water was the subject of experiment. The action, it will be seen, was more vigorous in distilled than in the impure waters.

* *Toxicologie Générale*, Vol. I. p. 616. † *Proc. Brit. Ass. Athen.*, No. 1087.

"TABLE XXII. — *Experiments with Lead and Graduated Solutions of Sulphate of Magnesia (Epsom Salt).*

Days.	Distilled Water.	Distilled Water and $\frac{1}{10000}$ of Epsom Salt.	Distilled Water and $\frac{1}{100000}$ of Epsom Salt.	Distilled Water and $\frac{1}{1000000}$ of Epsom Salt.
1	——	——	——	——
3	5.000	2.500	2.000	1.750
5	20.000	1.500	2.000	1.800
6	4.000	2.500	2.000	1.800
7	3.000	1.800	2.000	1.500
8	2.500	2.500	2.000	0.800
10	3.000	1.800	3.000	1.800
11	2.000	1.500	1.800	1.500
12	3.000	1.200	2.000	0.800
13	2.000	1.200	1.200	0.800

"TABLE XXIII. — *Experiments with Lead and Graduated Solutions of Chloride of Sodium.*

Days.	Distilled Water.	Distilled Water and $\frac{1}{10000}$ of Salt.	Distilled Water and $\frac{1}{100000}$ of Salt.	Distilled Water and $\frac{1}{1000000}$ of Salt.
1	——	——	——	——
3	5.000	2.500	2.000	1.500
5	20.000	1.800	2.500	2.000
6	4.000	1.800	1.800	2.000
7	3.000	1.800	2.000	2.000
8	2.500	2.000	2.000	1.800
10	3.000	2.500	2.250	2.500
11	2.000	1.800	1.800	1.500
12	3.000	1.200	1.200	1.200
13	2.000	1.000	1.200	1.200

"*Coats that form on Lead.* — In seeking to ascertain the nature of the protecting coat which forms in all the waters hitherto experimented with, the influence of organic matter was first considered. 500cc. of each of several waters were evaporated to dryness over a water-bath, ignited, and redissolved in an equal measure of distilled water. There remained a small insoluble residue, which readily dissolved, with effervescence, in hydrochloric or acetic acid, — indicating carbonate of lime. Bars of lead were exposed to these prepared solutions. A bluish-white coat formed upon the lead in each.

" TABLE XXIV. — *Experiments with the several Waters deprived of their Organic Matter and Carbonate of Lime.**

Days.	Distilled Water.	Albany.	Cam-bridge.	Cochit-uate.	Croton.	Fairmount.	Jamaica.	Troy.
1	3.000	0.000	0.500	5.000	6.000	15.000	5.000	4.000
4	1.000	0.000	0.500	0.500	2.500	2.000	12.000	2.000
5	1.500	0.010	0.010	0.020	8.000	1.000	15.000	0.500
8	2.000	0.010	0.500	0.800	10.000	2.000	3.000	1.000
9	0.500	0.050	0.050	0.100	4.000	4.000	1.500	1.500
11	0.500	0.100	0.100	0.100	0.800	0.100	0.100	0.100
18	0.500	0.800	0.800	0.800	20.000	30.000	0.800	0.500
37	1.500	1.000	2.000	1.250	12.000	3.000	0.700	1.500
42	1.250	1.000	1.000	2.000	2.000	20.000	8.000	0.100
44	15.000	1.500	1.000	0.800	0.200	0.100	0.100	0.100
47	15.000	0.500	0.100	1.500	0.500	0.100	0.100	0.100
48	0.200	0.100	0.300	0.100	1.000	0.200	0.100	0.300
49	0.400	0.400	0.500	0.300	2.000	0.500	0.400	0.400
50	0.500	0.200	0.900	1.000	2.000	2.500	1.000	0.100
52	1.750	0.010	1.800	1.800	1.000	3.000	0.100	0.100

" It will be seen, on comparing the results of their actions with those of the natural waters, that they are more protracted and vigorous, that they approach more nearly the action of distilled water, and that no protecting coat can be said to have formed. Three kinds of coating upon lead have fallen under my notice : a bluish-gray one, which, according to Winkelbleck, Mitscherlich, and others, is a simple suboxide ; a reddish one, which formed in Croton, Schuylkill, and Jamaica waters ; and a white one. The coat of *suboxide* is insoluble in water. When the quantity of oxygen in solution in a given water is small, this coat will be first formed. It is the only one I have seen in Croton pipes less than two years in use. The addition to this coat of slimy organic matter, oxide of iron, and, to some extent, carbonate of lead, forms the *reddish* coat, the impermeable character of which, for all practical purposes, is illustrated in the appearance of Croton pipe five years in use, and already referred to. The *white* coat, it has been observed, consists chiefly of carbonates and sulphates.

" *Solubility of Oxide of Lead.* — I have already noticed the contrariety of opinion upon the solubility of the oxide of lead. I have repeated the experiments of Yorke, and confirmed his results, and am,

* Professor Silliman, Jr., has remarked of the alkaline reaction which the redissolved residues gave. The reaction of the above solutions was not observed. In their extreme dilution, an alkaline reaction could not have been appreciable.

moreover, satisfied that, had Thompson and Philips concentrated the filtrates which they supposed to contain no lead, they would have detected it without difficulty. A flask containing distilled water and lead shavings was corked and placed aside for a few days. A deposit of carbonate and hydrate of lead formed around and upon the lead shavings. The contents of the flask were carefully poured upon a double filter of Swedish paper, and the filtrate concentrated. It gave a distinct precipitate with hydrosulphuric acid.

" *Tea and Coffee Grounds unite with Lead in Solution.* — It has been an occasion of surprise, that numerous families have for a long period employed well-water that corroded leaden pipe so rapidly as to require replacement in from six to eighteen months, and yet, so far as they or their physicians know, have suffered no illness attributable to the water. This fact suggested two considerations: — 1st. Are all lead compounds equally poisonous ? 2d. If so, is the quantity which finds its way into the organism sufficient to produce the maladies attributed to lead ? It may be assumed that water flowing directly through a leaden pipe of an inch bore and not more than thirty feet in length will ordinarily be identical in constitution with that in the source from which it is drawn. That only which has been some time at rest would be expected to contain lead. Accordingly, there is more care that the water first drawn be thrown away. The first morning draught is usually in the form of tea or coffee. The following experiments throw light upon this point. To boiling water containing lead in solution tea was added, in the quantity usually taken in the preparation of the beverage (a gramme to 50cc.), the temperature maintained three minutes just below the boiling point, and the decoction filtered off. The filtrate was evaporated to dryness, ignited, redissolved, and the precipitate with hydrosulphuric acid made and estimated as already described.

" I. 50cc. of lead solution, containing one thousandth of its weight of lead, with 1gr. of black tea, lost ninety-nine hundredths of its lead.

Originally present,	0.05gr. of lead.
After separation from the grounds,	0.0005 "

" II. 55cc. of solution containing one tenth as much lead as the above, with the above quantity of tea, lost more than eleven twelfths of its lead.

Originally present in solution,	0.005gr. of lead.
After separation from the grounds,	0.0004 "

" The experiments with coffee yielded the following results: —

"I. 50cc. of lead solution, containing one thousandth of its weight of lead, with 10cc. of coffee-grounds, were boiled three minutes, and the decoction poured off. The residue was drained through Swedish filtering-paper, the filtrate added to the liquor poured off, and evaporated to dryness, ignited, redissolved, treated with hydrosulphuric acid, and the precipitate estimated as before. It had lost more than forty-nine fiftieths of the lead.

Originally in solution, 0.05gr. of lead.
After separation from the grounds, 0.0009 "

"II. 50cc. of solution, containing one tenth as much lead as that in the last experiment, were boiled with 5cc. of coffee-grounds, and treated as above. It had lost more than eleven twelfths of its lead.

Originally in solution, 0.005gr. of lead.
After separation from the grounds, 0.0005 "

"These results contribute to account for the circumstance mentioned above.

"Other Materials than Lead for Service-pipes. — I have remarked that this investigation was instituted chiefly with a view to determine the trustworthiness of lead. Experiments have, however, to some extent, been made with other substances. The general conditions have been observed in experimenting with them that had been regarded with lead, namely, equal volumes of water to equal surfaces of substance, that comparison might be instituted.

"Table XXV. — *Experiments with Copper Turnings.* Water concentrated to one third of its volume.

Days.	Distilled Water.	Albany.	Cambridge.	Cochituate *a*.	Cochituate *b*.	Cochituate *c*.	Croton.	Fairmount.	Jamaica.	Troy.
1	——	——	——	——	——	——	——	——	——	——
11	0.001	0.500	0.000	0.001	0.002	0.000	0.000	0.000	0.001	0.000
17	1.000	0.500	1.000	0.500	1.000	1.000	0.010	0.500	0.010	0.500
25	0.005	0.001	0.002	0.050	0.080	——	0.002	0.001	0.050	0.001
37	0.000	0.000	——	0.005	0.050	0.050	——	0.000	——	0.010

"These experiments show only a feeble action of aerated water on copper.

"Table XXVI. — *Experiments with Tin.* — The tin contained arsenic as an impurity. Chemically pure tin yielded precisely the same results when exposed to the same waters. Bars of size already mentioned. 10cc. of water concentrated to from 3 to 5cc. Precipitates

with hydrosulphuric acid and oxide of tin are both represented in the numbers below.

Days.	Cochituate.	Croton.	Fairmount.	Jamaica.	Distilled Water.	Albany.	Cambridge.	Troy.
1	——	——	——	——	——	——	——	——
2	0.100	0.100	0.000	0.000				
4	0.020	0.010	0.000	0.000	0.100			
6	0.010	0.010	0.000	0.000	0.000			
8	0.001	0.000	0.000	0.000	0.001			
10	0.005	0.000	0.000	0.000	0.000			
12	0.005	0.001	0.001	0.001	0.001	0.500	0.500	0.500
17	1.000	1.000	1.000	1.000	1.000	0.050	2.000	2.000
26	8.000	15.000	10.000	8.000	0.010	0.000	50.000	0.010
38	10.000	25.000	8.000	10.000	3.000	7.000	1.000	10.000
75	10.000	15.000	15.000	10.000	4.000	4.000	7.000	20.000

" The action in ten days' exposure was inconsiderable. No coat formed on the tin.

" A portion of Cochituate water that had been standing two months in tin pipe, which was kindly furnished last February by the engineer of the water-works, was evaporated to dryness with carbonate of soda, and gave with the blowpipe a malleable metallic button. The *precipitated oxide* from this water, that from distilled water acting upon chemically pure tin, and that from Cochituate and the various other waters upon the impure tin, were identical in appearance.

" Lehman remarks of the solubility of tin in solutions of sal-ammoniac, alum, and bisulphate and bitartrate of potassa.* ' Lindes has examined the solutions which by boiling attack tin vessels. According to his experiments, tin is rapidly brought into solution, without precipitating the oxide by alum, sal-ammoniac, and bisulphate of potassa. Without dissolving the oxide, but merely depositing it, chlorides of barium and calcium, neutral carbonate and bicarbonate of potassa, sulphates of potassa, soda, and magnesia, chloride of sodium, tartrates of ammonia and potassa, and borate of potassa.' † These experiments were made with the aid of heat. Time accomplished the same end in all the waters I have employed, including distilled water, producing either solution or deposit of the oxide, *not* upon the tin, but the bottom of the containing vessel. Lindes did not observe that saltpetre acted with the aid of elevated temperature. The time in his experiments

* *Taschenbuch der Chemie*, 1848, S. 192.

† Berzelius, *Jahresbericht*, Vol. XII., S. 110, 1833.

was probably too short, as I have found that tin at common temperatures yields the insoluble oxide in a solution of saltpetre.

"TABLE XXVII. — *Experiments with Tinned Copper Pipe.** — Two days' exposure. 100cc. condensed to 5cc.

Days.	Distilled Water.	Cochituate.	Croton.	Jamaica.	Fairmount.	Albany.	Cambridge Hard Water.
2	15.000	20.000	10.000	20.000	20.000	20.000	20.000

"Upon the authority of Dr. Hayes† I have ventured to speak of the safe use of tinned copper pipes, notwithstanding the fact of the slow erosion.

"*Iron service-pipes*, such as are employed for the circulation of hot water and steam, for warming purposes, have been proposed, and are in use. I am informed that some persons who laid them down a few months since for the distribution of Cochituate water have decided to replace them with lead, on account of the rust, which unfits the water for washing.

"Iron pipes *tinned* within and without have been submitted to me. I have no knowledge of the durability of the coat of tin. Should it prove to be lasting, this pipe will have the double advantage of the strength of iron and the feeble action which tin experiences.

"A pipe consisting of *gutta percha* and *India rubber* was found to yield an extract to water, which gradually diminished, until the taste was no longer impaired. The strength of the specimen submitted to me was not sufficient to sustain the pressure of actual service.

"Pipes of pure *gutta percha* have been proposed by Dr. Webster, and, from all the experiments I have been able to make, as well as from the known chemical properties of the substance, I shall not be surprised to find that they may be successfully introduced into wells. Its susceptibility to extension when heated, if only to the temperature of boiling water, precludes its use for some of the purposes of service-pipes.

"*Glass pipes* have been used for the transmission of water, where the descent was moderate, and the head inconsiderable. Where the pressure is sufficient to supply the upper rooms of houses, practice has

* The pipe, five eighths of an inch in diameter, was washed with warm diluted hydrochloric acid, then with warm diluted potassa, then with distilled water, and then successively exposed to the different waters mentioned above.

† *Report to the Board of Consulting Physicians*, Boston, 1848.

shown that the pipes are liable to be shattered by the concussion occasioned by shutting off the water.

"SUMMARY OF CONCLUSIONS RELATING TO THE DIFFERENT KINDS OF WATER AND LEADEN SERVICE-PIPE. — The waters used by man, in the various forms of beverage and for culinary purposes, are of two classes, viz.: —

"1. *Open waters, derived from rain-falls and surface drainage, like ponds, lakes, rivers, and some springs; and* 2. *Waters concealed from sunlight, and supplied by lixiviation through soils or rock, or both, of greater or less depth, such as wells and certain springs.*

"They differ, (*a.*) in temperature; well-water, through a large part of the year, is colder than lake, pond, or river water; — (*b.*) in the percentage of gases in solution; recently drawn well-water, in summer particularly, parts with a quantity of air upon exposure to the surface temperature. In winter these relationships must to some extent be inverted, in high latitudes for a longer, and in lower latitudes for a shorter period. (*c.*) They differ in the percentage of inorganic matter in solution; well-waters contain more; — (*d.*) in the relative proportions of salts in solution; well-waters contain more nitrates and chlorides; — and (*e.*) in the percentage of organic matter; well-waters contain less.

"*Relations of Lead to Air and Water.* — (*a.*) Lead is not oxidated in dry air, or (*b.*) in pure water deprived of air. (*c.*) It is oxidated in water, other things being equal, in general proportion to the amount of uncombined oxygen in solution. (*d.*) When present in sufficient quantity, nitrates in neutral waters are, to some extent, reduced by lead. (*e.*) Both nitrates and chlorides promote the solution of some coats formed on lead.

"(*f.*) Organic matter influences the action of water upon lead. If insoluble, it impairs the action by facilitating the escape of air; if soluble, by consuming the oxygen in solution, and by reducing the nitrates when present. The green plants, so called, and animalculæ which evolve oxygen, are abundant in open waters in warm weather only, and of course when the capacity of water to retain air in solution is lowest; so that, although oxygen is produced in open waters by these microscopic organisms, it does not increase the vigor of their action upon lead.

"(*g.*) Hydrated peroxide of iron (iron-rust) in water is not reduced by lead. Hence may be inferred the freedom from corrosion of leaden pipes connected with iron mains, so far as the reduction of the pulverulent peroxide of iron may influence it.

"(*h.*) Alkaline chlorides in natural waters deprived of air do not corrode lead. (*i.*) Salts, generally, impair the action of waters upon lead, by lessening their solvent power for air, and by lessening their solvent power for other salts. A coat of greater or less permeability forms in all natural waters to which lead is exposed. The first coat (*j.*) is a simple suboxide absolutely insoluble in water, and solutions of salts generally. This becomes converted in some waters into a higher oxide, and this higher oxide, uniting with water and carbonic acid, forms a coat (*k.*) soluble in from 7,000 to 10,000 times its weight of pure water. The above oxide unites with sulphuric and other acids which sometimes enter into the constitution of the coat *k*; — uniting with organic matter and iron-rust, it forms another coat (*l.*) which is in the highest degree protective. The perfection of this coat, and of the first above mentioned, may be inferred from the small quantity of lead found in Croton water (New York), after an exposure in pipes of from twelve to thirty-six hours, and from the absence of an appreciable quantity in Fairmount water (Philadelphia), after an exposure of thirty-six hours, when concentrated to one two-hundredth of its bulk.

"*Reasons why the Water of Lake Cochituate served through Iron Mains and Leaden Distribution-pipes may be safely employed as a Beverage in any Form.*

"(*a.*) It has the small measures of air, nitrates, and chlorides, the large proportion of organic matter, soluble and insoluble, and exposure to the sun, above referred to as grounds of distinction in the relations to lead between lake, pond, or river water, and well-water.

"(*b.*) In experiments with Croton, Fairmount, Jamaica, and Cochituate waters, made with lead, lead soldered to iron, to tin, to copper, and to brass, prolonged from mid-winter to the middle of summer, the relations of the last of these waters to lead were found to be as favorable as were those of either of the others.

"(*c.*) Large numbers of individuals in the daily and unrestricted use of Fairmount, Croton, and Jamaica waters served through lead are not known by physicians of great eminence and extensive practice to suffer in any degree from lead maladies.

"(*d.*) A coat forms upon lead in Cochituate, as in the other waters above mentioned, which for all practical purposes becomes, in process of time, impermeable to and insoluble in the water in which it occurs."

Lieutenant C. H. Davis, U. S. N., presented a paper upon the "Geological Action of the Tidal and other Currents of the Ocean."

"The object of this memoir," he said, "is to present the subject of the tides and currents of the ocean as a geological problem. The tides have heretofore been regarded only as an astronomical problem. It is the prevailing opinion among geologists, at present, that the actual condition of the earth and the changes of former periods are to be ascribed to causes now in operation. Among the present active causes of change, the ocean holds a prominent place. But it has been supposed to operate principally by means of the agitations of its surface, or by violent and tumultuous disturbances. The tides and currents of the sea have been treated in a general way only. This memoir announces the discovery of a permanent, systematic, and uniform relation between the tidal currents and those shores which are now, or have been at any earlier period, subjected to their action. The currents created by the tides are to be counted among the most effective agents employed throughout all periods in giving their present form and body to the great continents, and in preparing a suitable home for that marine animal life of which there is such an enormous display in the fossils of earlier strata, and which constitutes at present an important part of the sustenance of man.

"If this agency be established, the whole economy of the earth's condition will appear to be connected with the normal and regular movements of the ocean, rather than with its violent and irregular action. The title of the Geological Action of the Tides does not exclude the consideration of those currents of the ocean produced by other causes, which exert an influence by coming in contact with the land. But these currents hold a subordinate place to the tides. They owe their existence and direction, in part, to the continents, and move always in the same course. But the tides have contributed largely in giving their present forms to the continents, and are themselves constantly undergoing alternate changes of rest and motion, flux and reflux, by which they are peculiarly qualified for their office of distribution and construction. The view now presented will account for the alluvial deposits on this coast, and for similar sandy formations elsewhere, as in Holland, the Landes of France, Northern Peru, &c. It will explain the geological peculiarities of the great plains of North

and South America, and suggest the mode of formation of the great deserts. Ascending to the earlier periods of geology, it will account for the situs of the aqueous deposits in those periods, as the post-pliocene, tertiary, and cretaceous. The views presented in the memoir are the result of a study of the tidal currents on the alluvial shores of the United States, and particularly on the New England coast. This study has led to the discovery of a threefold relation in form, amount, and locality between these currents, and the materials transported by them. The certain relation between the tidal currents and the alluvial deposits in structure, position, and amount establishes a principle of conformation in the latter, by means of which the geologist will be enabled to reason back from the deposits of earlier periods to the nature of the currents by which they were made, as the character of the present formations on the borders of the sea and in its depths is readily decided when the peculiarities of the local currents are ascertained." [This memoir has been printed *in extenso* in the current volume of the Memoirs of the Academy, Vol. IV., New Series.]

Dr. Pierson read a communication from Dr. Usher Parsons, of Providence, giving a detailed account of a tornado that passed near Providence, Rhode Island, at 3 o'clock, P. M., taken from minutes made at the time.

"Whilst a heavy rain was falling, a black cloud was seen in the west, which seemed to send down towards the earth a very dark elongated cone. It commenced its career, as its traces afterwards proved, in Johnston, about five miles west-southwest of Providence, and moved in a north-northeast direction, at the rate of ten or twelve miles the hour, passed across the head of Narraganset Bay, and moved onward in a straight line eight or ten miles, towards Dighton. The blackest part of the cloud was the centre of its under or convex side, whence the cone descended. There soon appeared floating substances, both in the cone and cloud, which were mistaken by many persons for birds whirling about and carried along seemingly unable to extricate themselves from the vortex. Among its first ravages was an orchard in Johnston, the trees of which were uprooted or broken, and the fences, and even stone walls, were swept away. Passing along over the summit of a hill or ledge of rocks one hundred feet high, it overthrew and demolished a small powder-house, containing thirty kegs of powder used in blasting, and neither the kegs nor their contents have ever been found. Near

this it uprooted a solitary large tree, and carried it twenty or thirty yards, to a valley at the farther side of the hill. Near this it unroofed two barns, a workshop, and a dwelling-house. All the doors of the house were burst open outwardly. A female standing in the middle of a room was hurled out of the door, and carried in a line with the progressive tornado across the road, and lodged against a fence. A wagon standing near was lifted and carried some distance. The approach of a whirlwind was apprehended by a workman in the shop, before it had struck, from the falling of a shower of apples on the roof, which it seems had been carried into the air from the orchard it had passed through, and which were precipitated from the anterior edge of the cloud. In a few seconds the pendant cone reached the shop, and unroofed it. A few rods farther in its progress, it took two women from a cart and carried them into a field. A few rods onward, it was seen approaching by a man who was leading a child, and fearing it would separate them, he clasped the child in his arms and fell on the ground; but they were both raised and borne for several yards. Passing through a potato-field, it dug up the potatoes, and scattered them far and wide. A small pond that lay in its path was drained; and, coursing through a large nursery-garden, it laid the shrubs and small trees as flat as if done by a roller, uprooted or fractured the large trees, and despoiled them of their foliage. An apple-orchard near by was served in like manner. Its approach being now discovered by a school-teacher, from a chamber window, she hastened her little scholars from the chamber, which was over a back kitchen, into the main building, which they had barely reached when a dairy-house was raised in the air and thrown on the school-room, breaking through its roof. It then passed over a bleachery, and destroyed a row of buildings, whose roofs appeared to open, and in a moment to rise up in the air. 'The whole house,' says Mr. Allen, who was within a few fathoms, 'appeared to crumble, and to become a mass of ruins in motion, which one could see through the cloud which enveloped it as a cloak of vapor. At the moment when the lower extremity of the cone passed over the crumbling building, all the *débris* appeared to be shot into the air, as if from an exploded mine.' The noise resembled that of the letting off of steam from an engine, only not so cavernous.

"The tornado had now reached the shore of Narraganset Bay, in crossing which it presented to view a water instead of a land spout, and established their essential identity in the minds of any who doubted.

In passing land, loose substances, as the *débris* of trees and buildings, are raised; in passing water, vapor and spray are raised, as in the ocean-spouts, by one and the same power. The shape of the lower cone is, however, better defined and more uniform in the water than in the land spout, the supply of materials to form the latter being more variable on land. There is, however, an exception to this, when the land-spout passes over desert sands, which give the appearance of moving pillars of dust extending from the earth to the skies. Bruce, in his travels, describes them as tall pillars, and says he sometimes saw many of them travelling together.

"The materials raised on the land were precipitated from the cloud before it had passed half way across the water, and on the opposite side it began to raise other movable substances. The water over which it passed was thrown into violent ebullition, like an immense cauldron, giving off a dense vapor and spray from its surface over an area of three hundred feet in diameter. A flash of light or electricity was seen by two observers darting through the cone, which was followed by a lessened commotion of the water, and a fall of rain. The track of the tornado was two to three hundred feet wide, deviating little if any from this width for several miles, its limits being strongly marked on the ground and upon trees. Even the same tree, that stood on the margin of the track, had its trunk killed, the sap being dried, as it were, on one side, and not on the other. Peltier describes similar effects from a spout in Fontenay, where 'the side of trees affected by the meteor was dried, while the opposite side preserved the sap.' The diameter of the shaft or cone, midway between the cloud and earth, was apparently less than fifty feet.

"The length of the visible cone that shot down from the cloud varied every minute. Sometimes it seemed to elongate in a tapering form quite to the earth, and then to shorten again. This, of course, was an optical illusion, for there is no descent of the spout in such cases, but merely a condensation of vapor, whose particles are constantly ascending, whether visible or not. And were the condensation of vapor to descend as far and wide upon the earth as the dynamic effects of the tornado extend, we should see the form of the terrestrial cone shooting upward to meet the descending inverted cone, — they would be continuous from the earth upward; and this, in fact, is exhibited in water-spouts, the water supplying the vapor to make a continuous visible spout, extending from its surface into the cloud, which slightly resembles in form an astral lamp.

"I took Professor Espy to view the ground soon after the tornado had passed, who drew my attention to the position of trees that were prostrated, and which lay with their tops turned inward and forward. He explained this in accordance with his published theory, which maintains that the dynamic effects upon the trees are of two kinds, — one resulting from the inward and vertical attraction, produced by a vacuum in the cloud, drawing the trees inward toward the cone, and upward, and uprooting them; the other, from its progressive course, which fells them with their tops forward. He states in his book that in nine spouts he has visited in New Jersey, the trees and corn all exhibited an inward and forward direction. He attaches less importance to the gyratory motion than Read, Redfield, and others have done, and believes it to be accidental. And Dr. A. D. Bache, of Philadelphia, who accompanied Professor Espy in some of his examinations of the traces of a spout, says: — 'I think it made out that there was a rush of air from all directions, at the surface of the ground, toward the moving meteor, this rush of air carrying objects with it. The effects all indicate a moving column of rarefied air, without any whirling motion near the surface of the earth.' In support of the same opinion, I may mention that the roofs of the barns and the wagons in the Providence tornado were lifted upwards, and carried along in a straight line, without being whirled round. Although the electrical effects attendant upon water-spouts and whirlwinds prove that they are closely connected with atmospheric electricity, yet no theory has been advanced that satisfactorily explains all the phenomena. Peltier has given the most rational exposition of the *modus operandi* of electricity of any writer I have met with. He has attempted to illustrate it by artificial means and experiments, and with apparent success. On this point Espy differs from him, in referring the dynamic effects of spouts chiefly, if not wholly, to a vacuum in the cloud, which he seems to believe may exist independently of electricity. It is, however, improbable that any rush of air, unaided by electricity, can produce a drying up of the leaves and of the sap in a tree. The electric fluid, moreover, is often seen darting through such meteors, as was the case in the spout now described."

Professor Edward Salisbury, of Yale College, and Dr. J. Mason Warren, were elected Fellows of the Academy.